PAINT and VARNISH Products

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES

DECEMBER 1956

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3. **Reduction or elimination of wrinkling**
4. **Improved color**

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an alkyd resin emulsion that eliminates fire and toxicity hazards

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PANAREZ 7-210	18+	200-220	150	0-1
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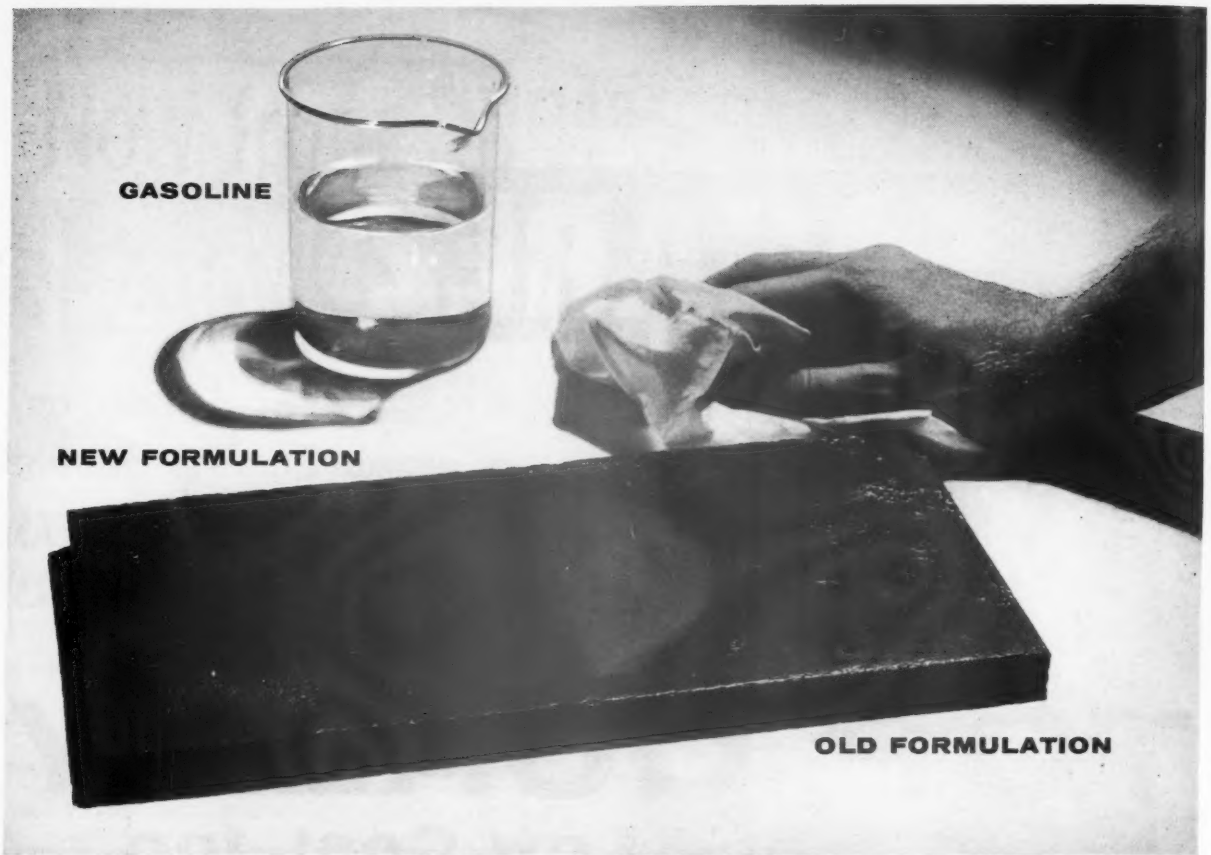

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Formerly PAINT and VARNISH PRODUCTION MANAGER
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VOL. 46 DECEMBER, 1956 NO. 13

Published Monthly by
Powell Magazines, Inc.
Executive and Editorial Offices
855 Ave. of Americas
New York 1, N. Y.
BRyant 9-0499

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PAINT and VARNISH PRODUCTION is published monthly except semi-monthly Kn February at Easton, Pa. by Powell Magazines, Inc. John Powell, president; Ira P. MacNair, vice-president and treasurer; Alice L. Lynch, secretary. Entered as second class matter at Post Office at Easton, Pa., Jan. 30th, 1952, under the Act of March 3, 1879. Subscription rates: United States and Possessions, $3.00 a year, $5.00 for two years, $10.00 for five years. Single copies 50c each. Canada, $4.00 a year. Pan American Countries, $4.00 a year. All other countries $8.00. Editorial and business office: 855 Avenue of the Americas, New York 1, N. Y. BR-9-0499.

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Editorial Comment

December, 1956

Drifting Away?

"WHAT the Appliance Industry Expects From Their Finishes" was presented in detail by E. L. Faneuf, manager. Chemical and Ceramic Research, Whirlpool-Seeger Corp. before the Industrial Product Finishes Forum held during the recent 69th NPVLA convention in Los Angeles, Calif.

In commenting on the many strides which have taken place in organic finishes for the appliance industry, Mr. Faneuf also dwelt on their present limitations.

For example, in discussing color stability at elevated temperatures, we quote Mr. Faneuf—

"This problem arises in the normal use of ranges and dryers, where with the exception of some formulas based on silicones, the organic finishing materials fall short of providing a satisfactory acceptable finish due to discoloration and loss of original physical properties because of the prolonged exposure to high temperatures. The problem of permanent color stability is one which the porcelain enamel industry has long cited as one of their strong points when compared to organic finishes. It behooves the technical personnel of the organic finishing companies to ask themselves how they can reduce this disadvantage or eliminate it without sacrificing the other desirable properties of organic finishes."

Other areas where organic finishes need improvement are in mar-, scuff-, chip-resistance, alkalai and abrasion resistance, and in corrosion. In all the above-mentioned cases, Mr. Faneuf pointed out the advantages of porcelain enamel over organic finishes. In some cases, the use of porcelain enamel eliminates the problem completely.

In remarking on the technological progress, in the porcelain enamel field, Mr. Faneuf discussed two significant developments.

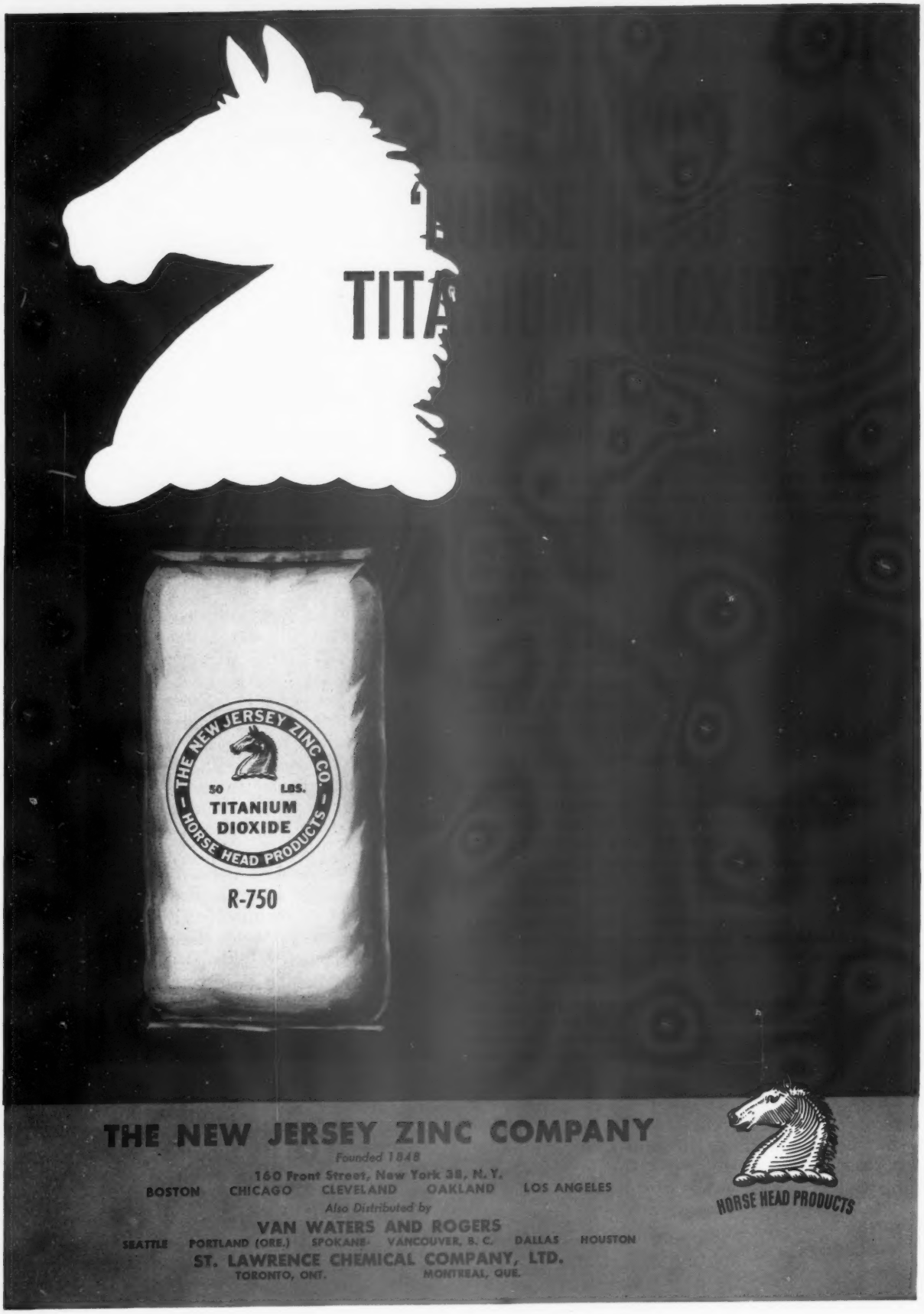
One development was the introduction of low temperature porcelain enamels by frit manufacturers. These enamels are said to overcome many of the problems of metal distortion and warping that occurred during firing operations. In addition, these low temperature enamels no longer require premium priced enamelling iron but can be used on cold rolled and hot rolled sheets. While the abrasion resistance of low temperature enamels is less than enamels fired between 1470° - 1550° F, they are still considerably better than our best available organic finishing materials.

Another development has been several processes which permit the application of the cover coat directly on the metal, thus eliminating the ground coat and reducing the cost.

The above example points up the fact that the manufacturers of organic finishes must be alert to the inroads being made by competitive materials. To cope with such competition requires careful examination by all manufacturers of product finishing materials.

Undoubtedly many firms have already initiated research with the intent of overcoming the shortcomings of organic finishing materials. However, this alone is not sufficient. Educating the advantages of organic finishes to the public is one approach that needs to be explored, according to Mr. Faneuf. Perhaps a promotional and advertising campaign directed to the consuming public similar to the one conducted by the National Paint, Varnish and Lacquer Association some years ago may be a step in the right direction.

Giving optimum service to the customer is another area where the supplier must give more consideration. Meeting delivery schedules is not enough. As Mr. Faneuf stressed, the passing on of information such as suggested economies, technical data, etc. are undoubtedly prime factors in keeping the customer fully satisfied. Improvement in this area alone could help prevent users of organic finishes from drifting toward some other type of decorative and protective material.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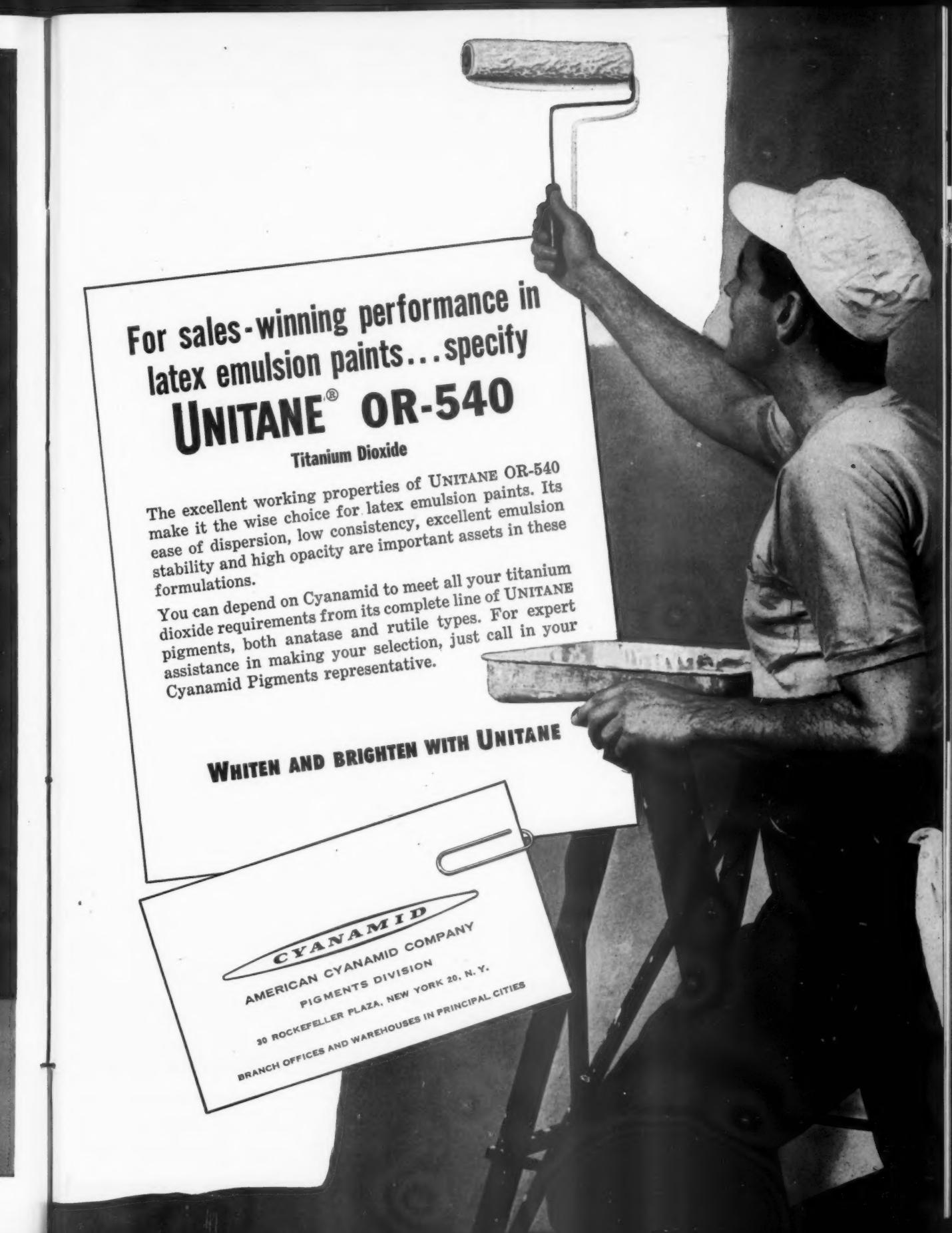
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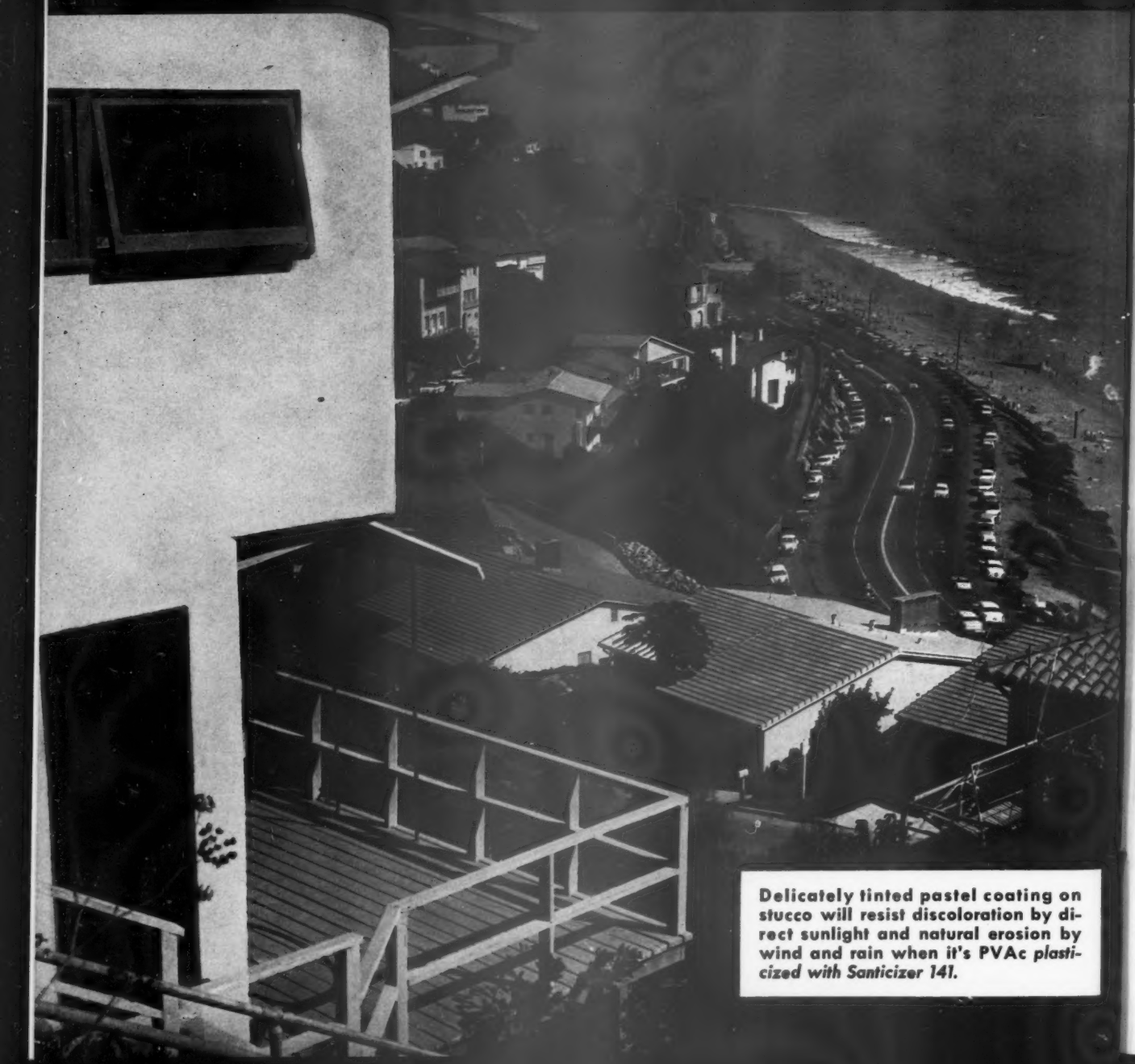

Delicately tinted pastel coating on stucco will resist discoloration by direct sunlight and natural erosion by wind and rain when it's PVAc *plasticized with Santicizer 141.*

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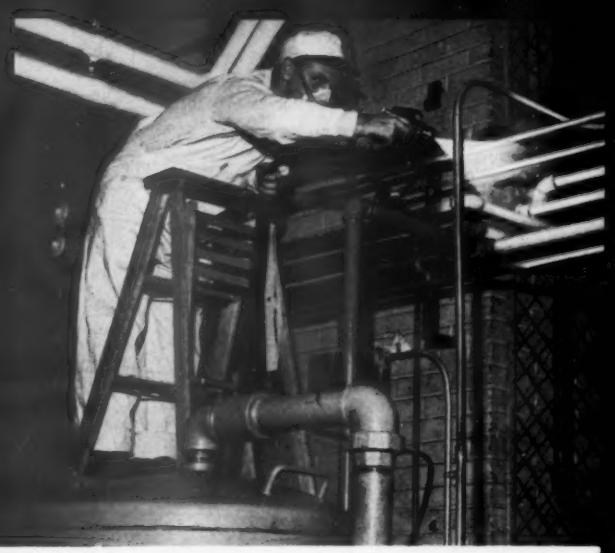
This PVAc primer-sealer will help top coats look better longer because it's plasticized with *Santicizer 160*—high in moisture resistance, low in volatility.



This heavy-duty industrial coating will resist attack by an unusually wide range of caustics, acids, and solvents because it's plasticized with *Aroclor 1254*.

Want better outdoor performance for PVAc paints? Controlled exposure tests prove that Santicizer* 141 (alkyl aryl phosphate) is outstanding for plasticizing PVAc systems designed for rugged outdoor wear. Because it helps paint films stand up against moisture, erosion, and ultraviolet degradation, Santicizer 141 is a natural choice for PVAc paints pigmented in delicate pastels or whites. *Santicizer 141 is one of the lowest-cost phosphate plasticizers on the market.*

Need more moisture resistance, permanence for PVAc primer-sealers? Santicizer 160 (butyl benzyl phthalate) boosts polyvinyl acetate's moisture resistance—all-important in primer-sealer systems. It is excellent for imparting resistance to greases and oils. And because volatility is low, Santicizer 160 offers higher plasticizer permanence.

Important: *Santicizer 160 is replacing dibutyl phthalate because it improves performance, but costs less.*

Looking for more chemical resistance in heavy-duty vinyl coatings? Aroclor* 1254 (chlorinated biphenyl) protects against a wider range of caustics, acids, and solvents than any other plasticizer. For an analytical comparison of Aroclor 1254 with other plasticizers for paints, write Monsanto for "*The Effect of Modifiers on the Chemical Resistance of Vinyl Films*," reprinted from the November 1955 issue of "*Official Digest*" (*Federation of Paint and Varnish Production Clubs*).

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For additional information on Monsanto plasticizers for surface coatings, contact your Monsanto representative or write:
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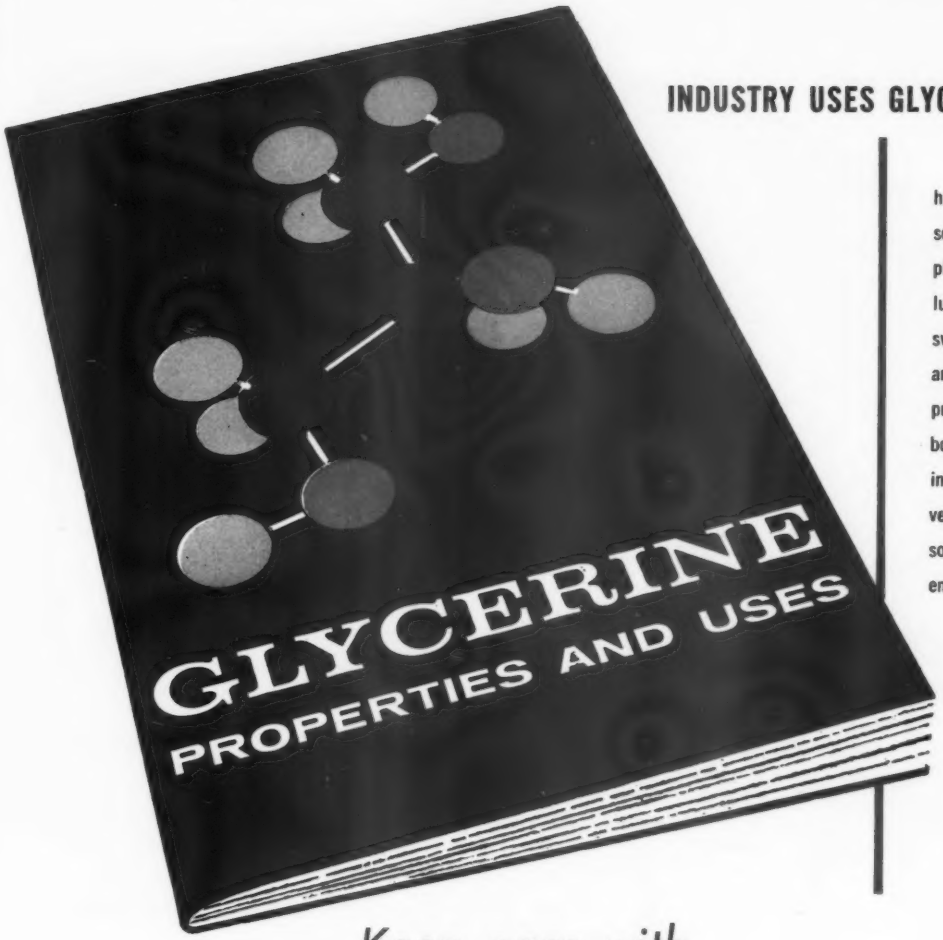

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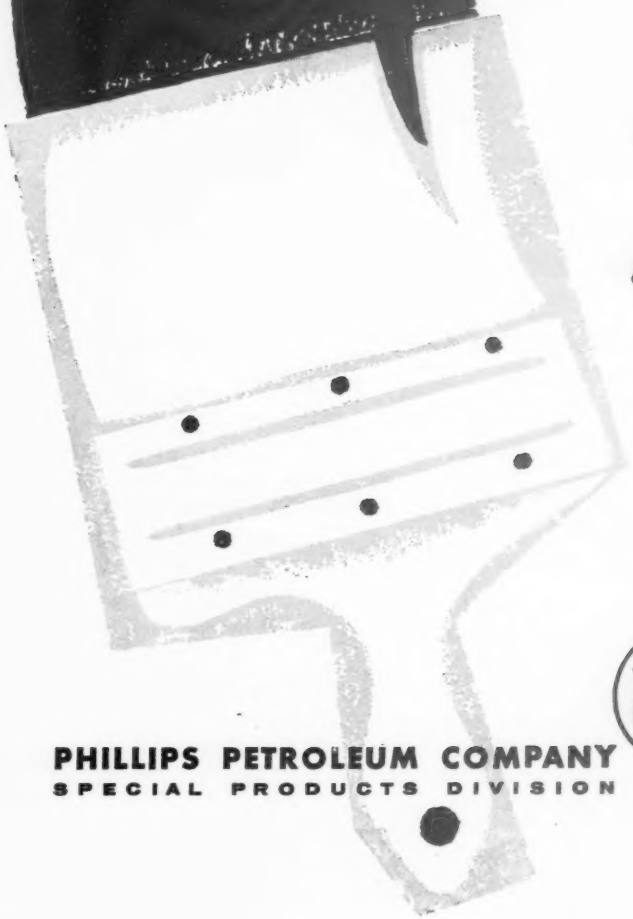

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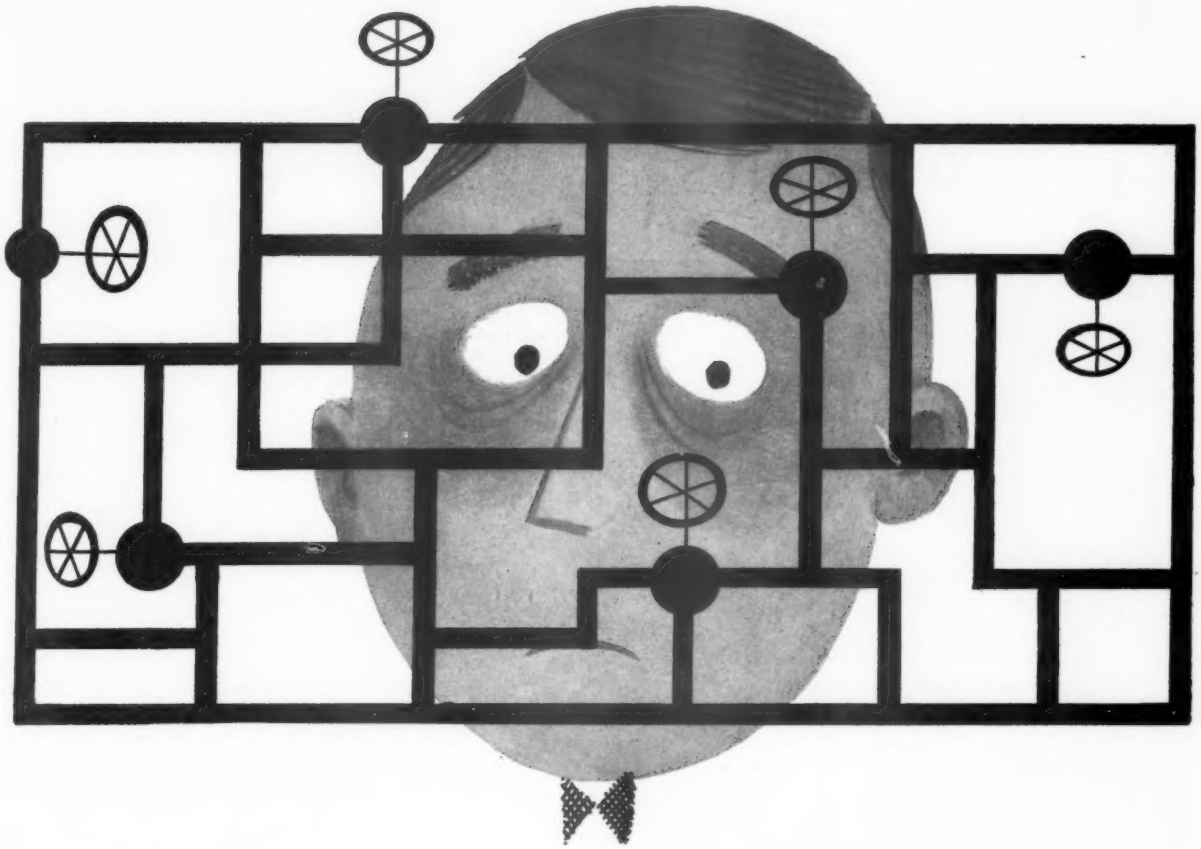

try **Velsicol** *hydrocarbon resins*

If processing worries follow you home and haunt you, it's time you had a chat with your Velsicol Representative. He's a qualified chemist, who can explain how manufacturers of paints, coating vehicles, and curing compounds have simplified processing through the greater solubility and compatibility characteristics of Velsicol Hydrocarbon Resins. He can supply samples for test work, and acquaint you with the services of the Velsicol Resins Laboratory. Contact him soon. There's no obligation involved—just opportunity.

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...your Velsicol representative, a qualified chemist who can show you how to make better paints and coating vehicles at lower cost with Velsicol Hydrocarbon Resins.

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Another big market turns to LATEX PAINTS

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Now, more and more hotels specify latex paints. 37% of all hospitals use latex paints. Every day more restaurants insist on these *modern* paints. The same is true of other institutions. Why? Because latex paints offer advantages no other paints can match!

Consider the fast-drying benefit. Rooms are painted *twice* and used the same day—with no painty odor. Equipment is rinsed clean in tap water to save bother and expense of cleansing solvents. With the easy application of these truly modern paints, minimum crews do maximum painting —and the colorful, cheerful atmosphere promotes good business, complements good food. Yes, institutions' demand for latex paints is *big*. And it's getting BIGGER every month!

Dow Promotions Boost Sales

A three-pronged attack is increasing sales to institutions. This year alone, eighteen full-page ads are scheduled in *Hotel Management*, *Modern Hospital* and *Institutions Magazine*. This is supported by promotions and direct mail to assure ever greater sales to every kind of institution.

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New BAKELITE (TRADE-MARK) WC-130 Latex

Formulations offer you Highest Pigment Loading in

High Quality - Low Cost Interior Paints

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BAKELITE WC-130 Latex offers

★ **Lower Investment in Equipment and Labor**

★ **No Intermediate Cooking or Emulsifying of Ingredients**

★ **Good Solvent Tolerance, Electrolyte Tolerance, and Freeze-Thaw Stability**

High-Pigment, High-Quality, Low-Cost Interior Paints Based on BAKELITE WC-130 Provide:

★ Excellent Hiding Power (see photograph).

★ Good Scrub Resistance within 24 hours—far *earlier* than even high-quality solvent-thinned flat wall paint, or most other latex-based paints.

★ Good Water Resistance, and resistance to staining and streaking.

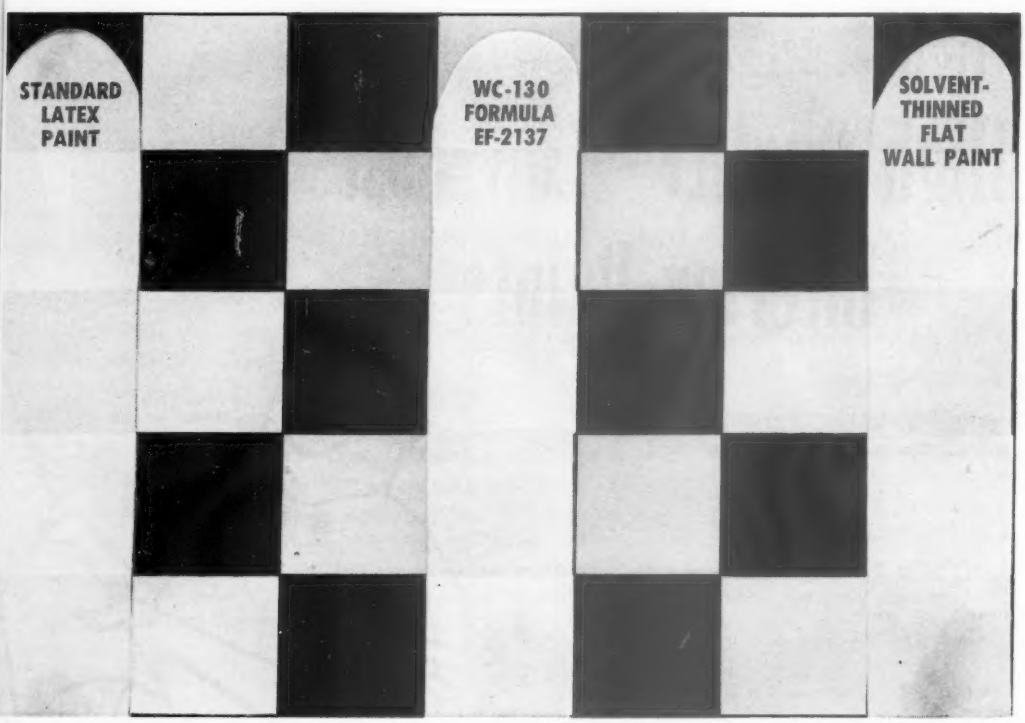
★ Color Retention and Tube-Color Acceptance are excellent.

★ Lapping quality is equal or superior to other paints. Leveling is excellent, better than most.

★ Easy application by brush, roller or spray. (Together with almost immediate washability, this is an excellent sales point for hospitals, hotels and similar users where disruption of service must be at a minimum.)

★ Can be applied over hot plaster—is self-priming.

★ Very Fast Drying—No Painty Odor.



Note this checkerboard test: The center panel is covered with WC-130 based paint. Hiding power is at least equivalent to that of a high-quality flat used over the right portion, and obviously much superior to a conventional latex-based paint used over the left portion.

simplified production

TWO TYPICAL FORMULATIONS FOR HIGH-QUALITY, LOW-COST PAINTS BASED ON BAKELITE LATEX WC-130

White Interior Wall Paint 60.1% PVC

Formula:	Lb.	Gal.	Wt. %
BAKELITE vinyl acetate resin latex WC-130 (58.5% N. V.)	164.77	17.72	14.09
Titanium dioxide Pigment[1]	210.93	6.03	18.04
"Lorite" filler	249.40	11.79	21.33
Water	360.28	43.24	30.81
Ethylene glycol	18.73	2.02	1.60
"Tamol" 731 dispersant (25% solution)	18.42	2.00	1.58
Ammonium polyacrylate (15% N. V. solution)[2]	17.42	1.98	1.49
CARBITOL solvent	14.10	1.65	1.21
Butyl CARBITOL acetate solvent	14.10	1.73	1.21
Dibutyl phthalate plasticizer	9.64	1.10	0.82
CELLOSIZE hydroxyethyl cellulose thickener WP-300 (7.5% N. V. solution)	82.60	9.69	7.07
Rust Inhibitor[3]	2.91	0.34	0.25
Pine Oil	1.16	0.15	0.10
Wetting Agent (25% solution)[4]	4.65	0.56	0.40
Theoretical Yield	**1169.11**	**100.00**	**100.00**

1 Rutile, semi-chalking grade, TT-T-425 Type II.
2 For example, "Good-Rite" K-707.
3 For example, "Nox-Rust" #702.
4 For example, 25% aqueous dispersion "Aerosol" OT.

MANUFACTURING PROCEDURE:

Preparation of Pigment Paste: Charge 68% of the water to a pebble mill. Add the 25% "Tamol" 731 Solution and pine oil, mix well. Add the pigments and grind for 24 hours.

White Interior Wall Paint 69.8% PVC

Formula:	Lb.	Gal.	Wt. %
BAKELITE vinyl acetate resin latex WC-130 (58.5% N. V.)	121.59	13.07	10.37
Titanium dioxide pigment[1]	148.32	4.24	12.66
"Lorite" filler	341.65	16.15	29.15
Water	390.59	46.90	33.33
Ethylene glycol	13.82	1.49	1.18
"Tamol" 731 dispersant (25% solution)	19.90	2.16	1.70
Ammonium polyacrylate (15% N. V. solution)[2]	12.86	1.46	1.10
CARBITOL solvent	17.73	2.07	1.51
Butyl CARBITOL acetate solvent	17.73	2.17	1.51
Dibutyl phthalate plasticizer	7.11	0.81	0.61
CELLOSIZE hydroxyethyl cellulose thickener WP-300 (7.5% N. V. solution)	71.86	8.43	6.13
Rust Inhibitor[3]	2.92	0.34	0.25
Pine Oil	1.17	0.15	0.10
Wetting Agent (25% solution)[4]	4.66	0.56	0.40
Theoretical Yield	**1171.91**	**100.00**	**100.00**

1 Rutile, semi-chalking grade, TT-T-425 Type II.
2 For example, "Good-Rite" K-707.
3 For example, "Nox-Rust" #702.
4 For example, 25% aqueous dispersion "Aerosol" OT.

MANUFACTURING PROCEDURE:

Preparation of Pigment Paste: Charge 68% of the water to a pebble mill. Add the 25% "Tamol" 731 Solution and pine oil, mix well. Add the pigments and grind for 24 hours.

Preparation of the Paint: Add the various components to a paint mixer in the following order: Agitation should be continuous during each addition and each component should be dispersed before the next is added. Pigment paste, ammonium polyacrylate solution, ethylene glycol, WC-130 latex, dibutyl phthalate, CARBITOL, Butyl CARBITOL acetate, rust inhibitor, wetting agent, balance of water, and CELLOSIZE WP-300 solution.

PROPERTIES: Viscosity—1200 cps. (Brookfield, 60 rpm, #4 spindle.) 95 Krebs units (300 gram weight).
Non-volatile—49.8%.
Pigment-volume concentration—60.1%.
Weight per gallon—11.7 lb.
Freeze stability—Excellent—3 cycles, room temp. to —6° F.

RAW MATERIAL COST: Approximately $1.17* per gallon. This can be reduced to approximately $1.14 per gallon by replacing the 83.12 lbs. of CELLOSIZE hydroxyethyl cellulose thickener WP-300 (7.5%) with 78 lbs. of 4.5% solution of CELLOSIZE hydroxyethyl cellulose thickener WP-4400 and adjusting the total N. V. by the addition of 2.5 lbs. of water.

*East of Rocky Mountains

PROPERTIES: Viscosity—1220 cps. (Brookfield, 60 rpm, #4 spindle.) 70 Krebs units (150 gram weight).
Non-volatile—49.75%.
Pigment-volume ratio—69.8%.
Weight per gallon—11.7 lbs.
Freeze stability—Excellent—3 cycles, room temperature to —6° F.

RAW MATERIAL COST: Approximately $.93* per gallon. This can be reduced to approximately $.91 per gallon if CELLOSIZE thickener WP-300 solution is replaced with an equal weight of a 4% solution of CELLOSIZE hydroxyethyl cellulose thickener WP-4400.

These formulas are for release only to coatings formulators. Based on Bakelite Company Laboratory results, they appear to offer merit in performance characteristics. However, because of the possible variations in the nature and quality of some of the ingredients used in these formulas and in the condition under which they are produced, Bakelite Company is unable to guarantee like or optimum values for all coating properties and performance data.

Data and suggestions made in this publication are not to be construed as recommendations to use any product in violation of existing patents covering any material or its use.

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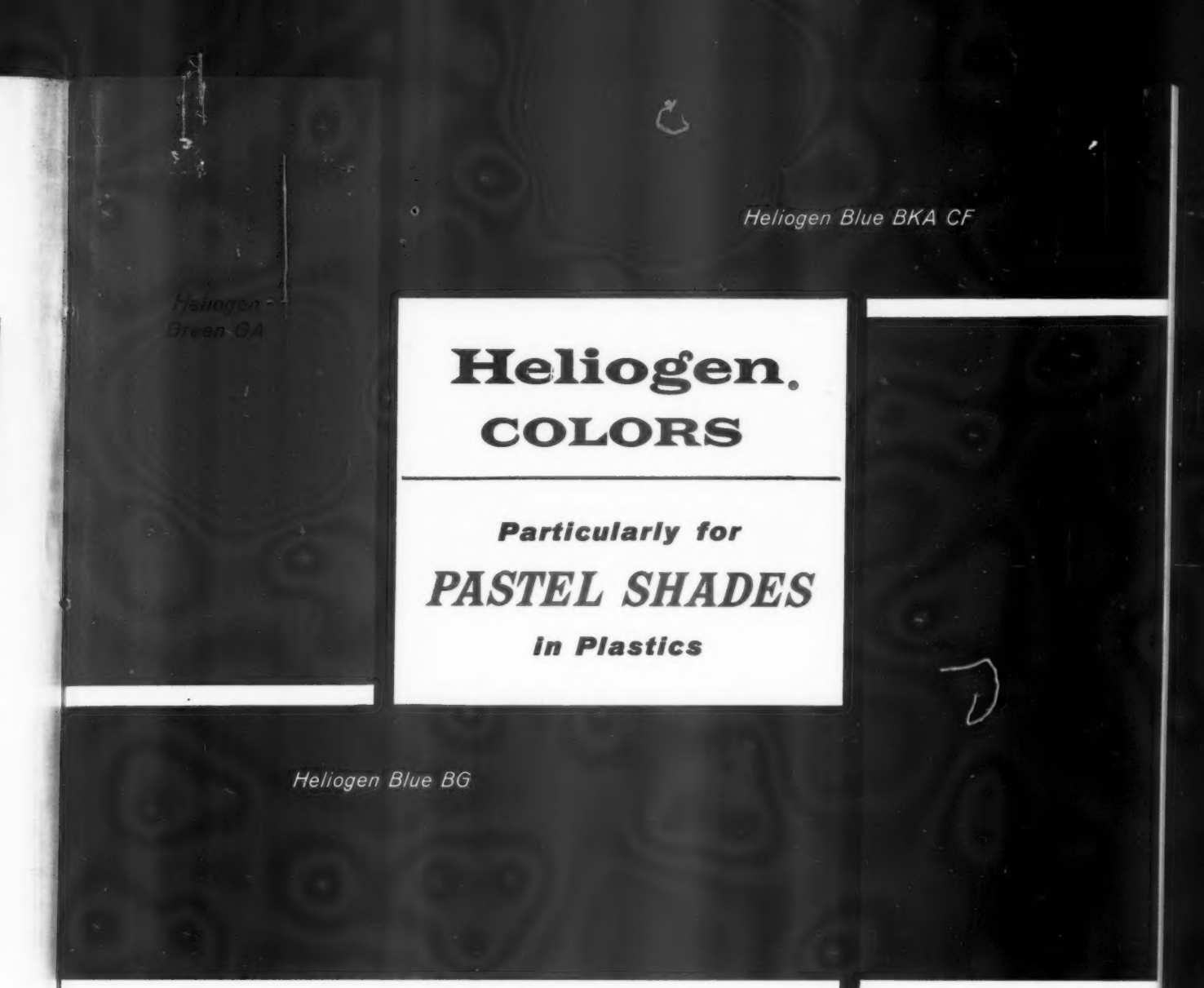

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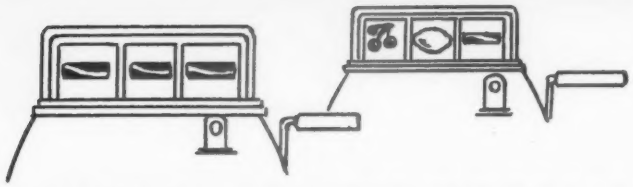

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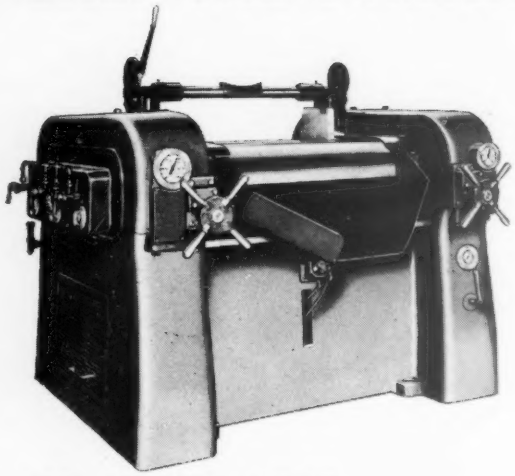

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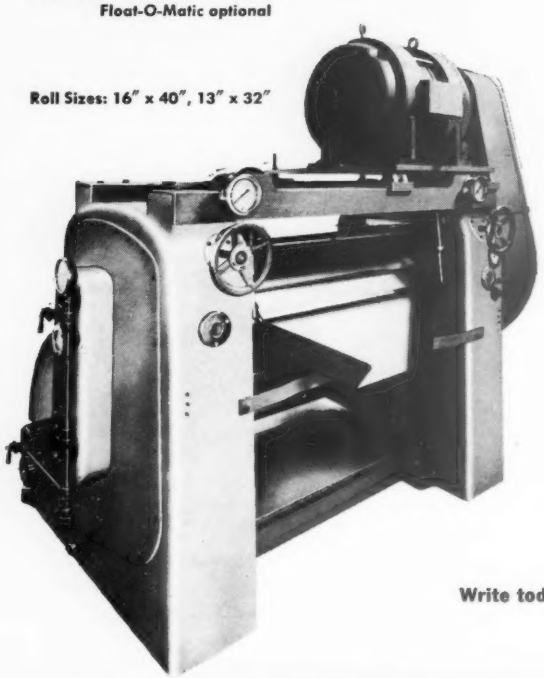

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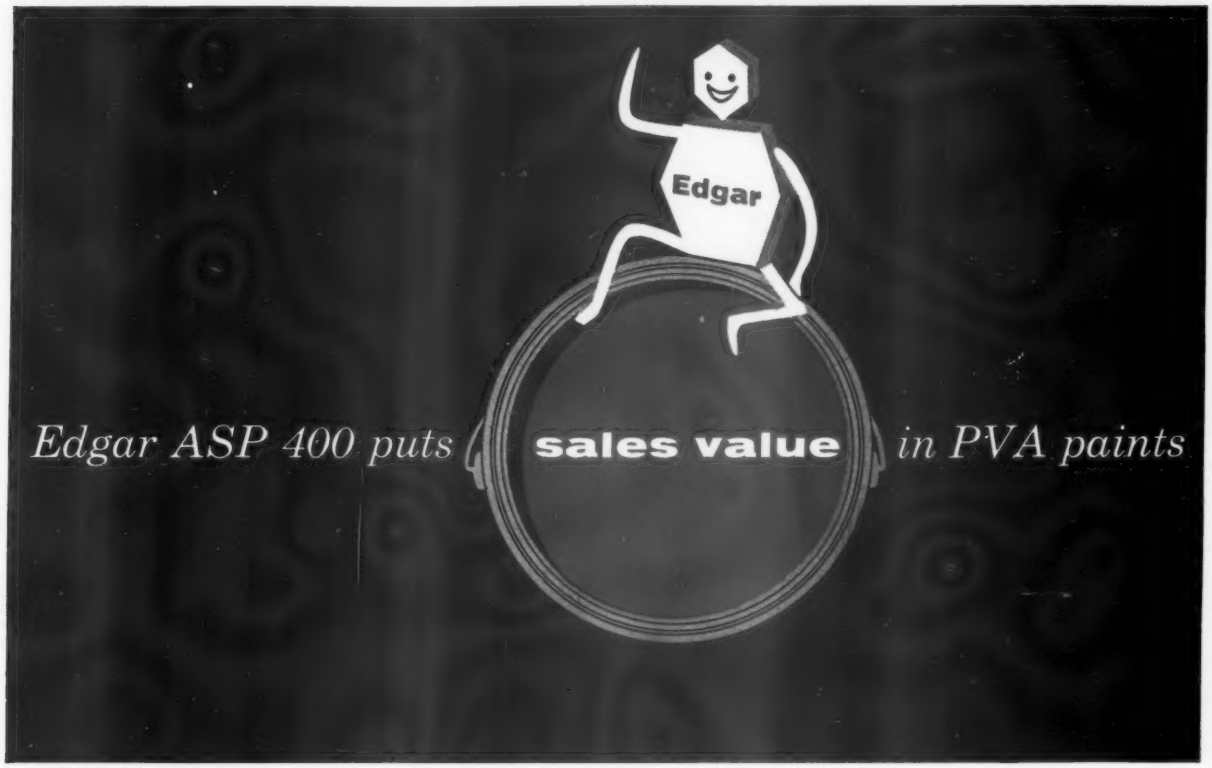

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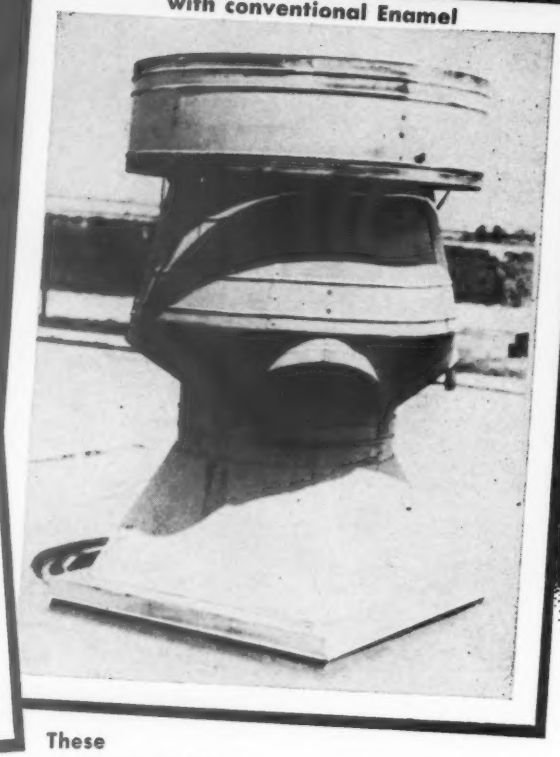

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The above 2 unretouched photos were taken at the warehouse of MARBON CHEMICAL, Plant II, at Gary, Indiana, located next to an industrial highway on one side and bordered by a railroad main line and an electric railroad on the other. Atmospheric conditions are typically those of a highly industrialized area—paper reprocess plant, sheet steel plants, oil refineries, steel mill smokes, and organic chemical residues.

Ventilators were painted in April, 1953 and were in the condition shown in June, 1956.

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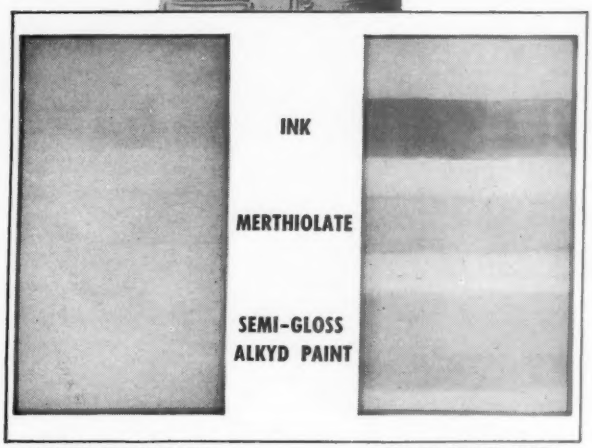
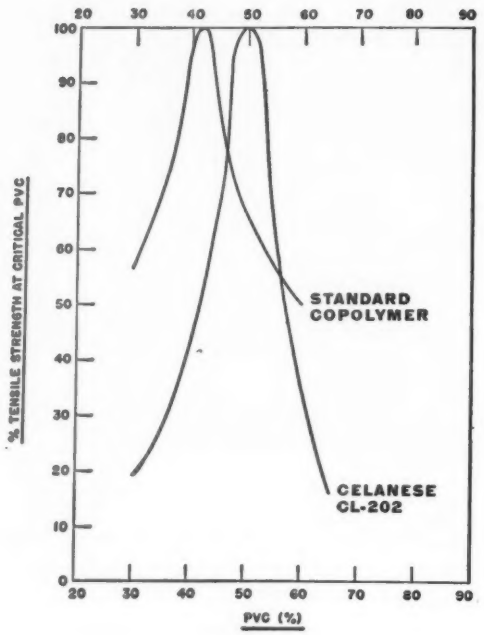


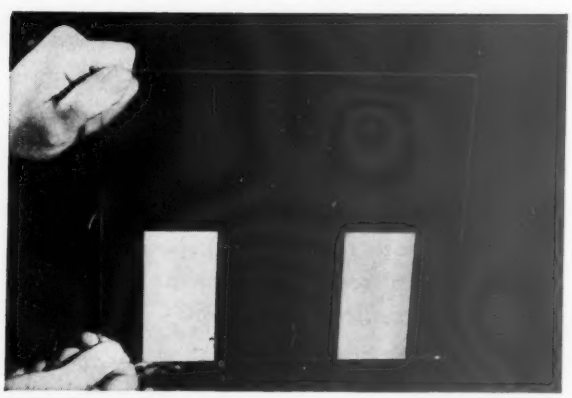
PRIMER SEALER WITH CELANESE EMULSION

PRIMER SEALER WITH STANDARD EMULSION

LOW TEMPERATURE COALESCENCE. Pictured above are two primer sealers identical in formulation except for the emulsions used (both homopolymers). These primers were cast (4 mil wet film) at *34° F. on glass* and allowed to *cure overnight at this temperature*. The paints were then stained and photographed from the reverse side of the glass. The primer on the left made with Celanese PVAc exhibited superior film coalescence as evidenced by the sharp reduction in stain penetration.

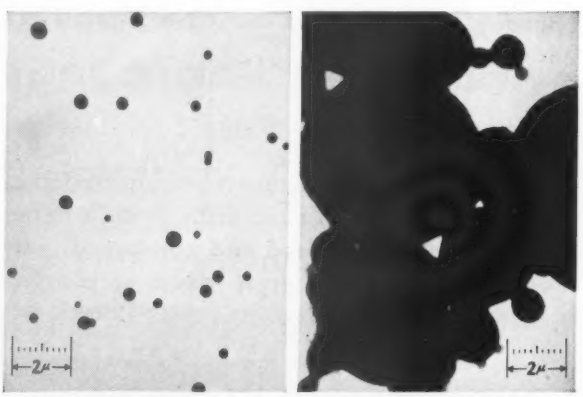


HIGH PIGMENT BINDING. Celanese emulsions are designed as paint vehicles. Because of this they exhibit extremely high pigment binding capacity. The above graph was prepared by plotting the tensile strength of paint films at progressively higher PVC's. A standard formulation was used and only the emulsions differed. In this comparison (both copolymers) the Celanese emulsion exhibited a critical PVC of 8% above the other copolymer.



STANDARD HOMOPOLYMER CELANESE CL-102 STANDARD COPOLYMER

SUPERIOR WATER RESISTANCE. Pictured above are three drawdowns of unpigmented PVAc films. (Both homopolymers plasticized with DBP.) The films were dried 72 hrs., then immersed in water for 5 min. The CL-102 film in the center maintains its crystal clear appearance and is substantially unaffected by the water.



CELANESE EMULSION STANDARD EMULSION

FINE PARTICLE SIZE. The "inside story" of Celanese improved PVAc emulsions is clearly demonstrated in the above photomicrographs. Fine particle size indicates higher pigment binding, better non-settling, tighter, more closely knit films and better penetration of chalky or porous surfaces when applied at low viscosities.

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both Celanese PVAc Emulsions can give you highest quality latex paints

With the new Celanse PVAc Emulsions—CL-102 Homopolymer and CL-202 Copolymer—you can formulate paints with quality unsurpassed by any latex paint, regardless of the *type* or *price* of the emulsion used. These are broad claims! . . .

And we can back up these claims because Celanese PVAc emulsions are specifically designed as paint vehicles and represent the latest advances in PVAc emulsion technology . . . advances like these:

Can be formulated at PVC's approaching those of alkyd flats.

Extremely fine particle size.

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Tough, flexible, weather-resistant films.

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Crystal-clear, water-resistant films.

Excellent mechanical stability; can even be milled.

A Celanese technical representative will be happy to discuss these characteristics with you and assist you with any technical problems you have. In addition, Celanese has prepared a manual of standard laboratory tests by which you can determine the properties of any resin emulsion vehicle. You can obtain a copy of this manual along with technical bulletins covering Celanese PVAc paint emulsions by filling out and mailing the coupon below.

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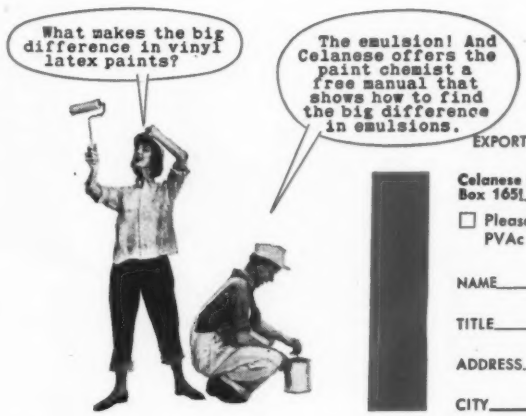
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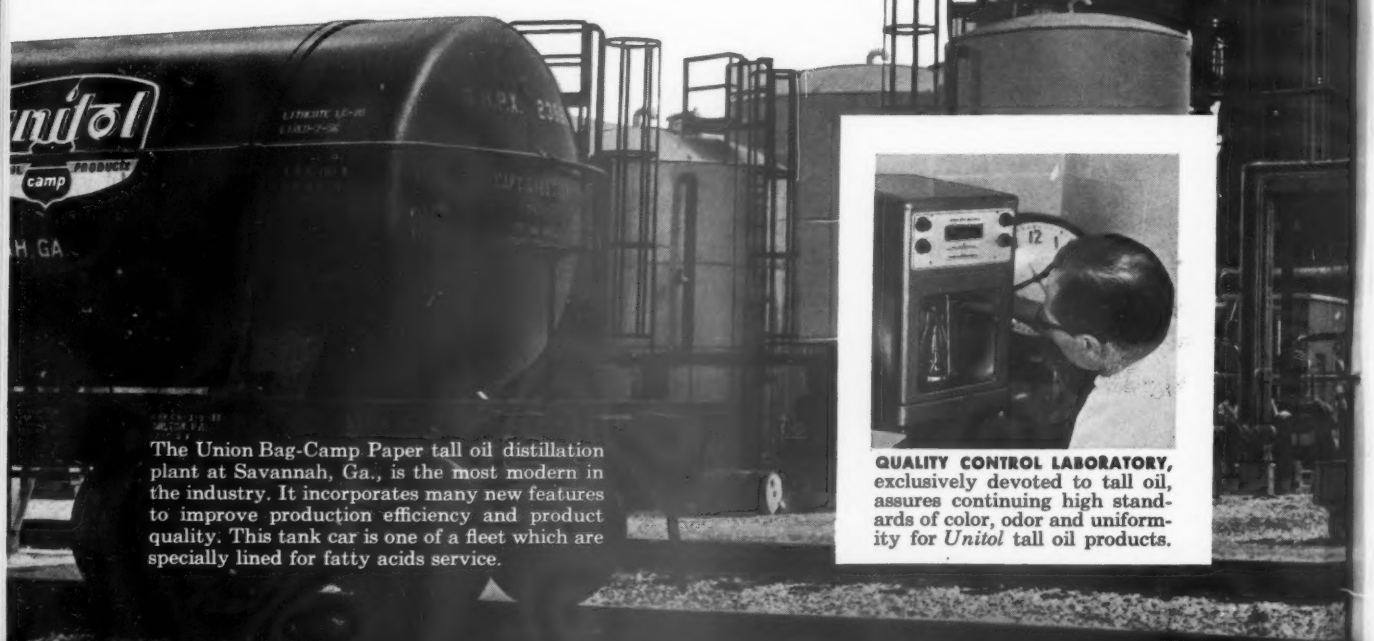

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LPG AS A FORK TRUCK

Good or Bad?

By

Russell Hastings*

The advantages claimed for liquefied petroleum gas as a fuel for industrial fork lift trucks have focused a great deal of attention on this subject in recent months. But while the number of LPG users is growing steadily, an even larger number of men concerned with materials handling have considered the use of LPG but are deferring decisions regarding it because of inadequate information or a lack of understanding as to how the advantages of LPG can be applied to their specific handling problems.

What is LPG?

Liquefied petroleum gas is gas kept in a liquid state by pressure. LPG can be either propane or butane, but is usually a mixture of the two. Its chief source is natural gas, from which LPG is condensed out as a by-product. Large quantities are also produced by oil refineries as a by-product of gasoline production, and additional amounts, previously burned off as waste, are now being realized from crude oil wells. LPG is measured in pounds; 4.46 pounds equal one gallon of gasoline.

What Are The Characteristics?

LPG has certain characteristics which distinguish it from gasoline:

—Propane boils at minus 44 degrees F., while Butane boils at 32 degrees F. (It is because of this decided difference in vaporization temperatures that the two gases are usually mixed. Butane alone, for example, would not be effective in sub-freezing temperatures.)

—At 100 degrees F., Propane develops 172 lbs. pressure while Butane develops 38 lbs. pressure.

—Octane rating of Propane is 100; Butane is 93.

These characteristics require slightly different construction for engines using LPG when compared with gasoline engines. Due to the higher octane rating of LPG, a higher compression ratio—from 8 to 1 to 9 to 1—is used to obtain fuel economy.

A cold in-take manifold is used with LPG since the fuel is a gas when it enters the manifold and does not require a hot spot to help vaporization—required when gasoline is the fuel.

A simple air-gas carburetor replaces the complicated, delicate gasoline carburetor.

Since LPG is a liquid only when under pressure, a fuel tank capable of withstanding high pressure is necessary. Clark's LPG fuel tanks, for example, are designed for working pressures of 240 psi with test pressures of 480 psi, and incorporate a relief valve to by-pass and vent pressure exceeding 375 psi.

What Are The Advantages?

Longer engine life resulting from use of LPG is probably the principal advantage of the fuel. Operating characteristics of LPG result in reduced engine wear, when compared with gasoline operation, and thus effect lowered engine maintenance costs. Just how this is accomplished is illustrated by the following points:

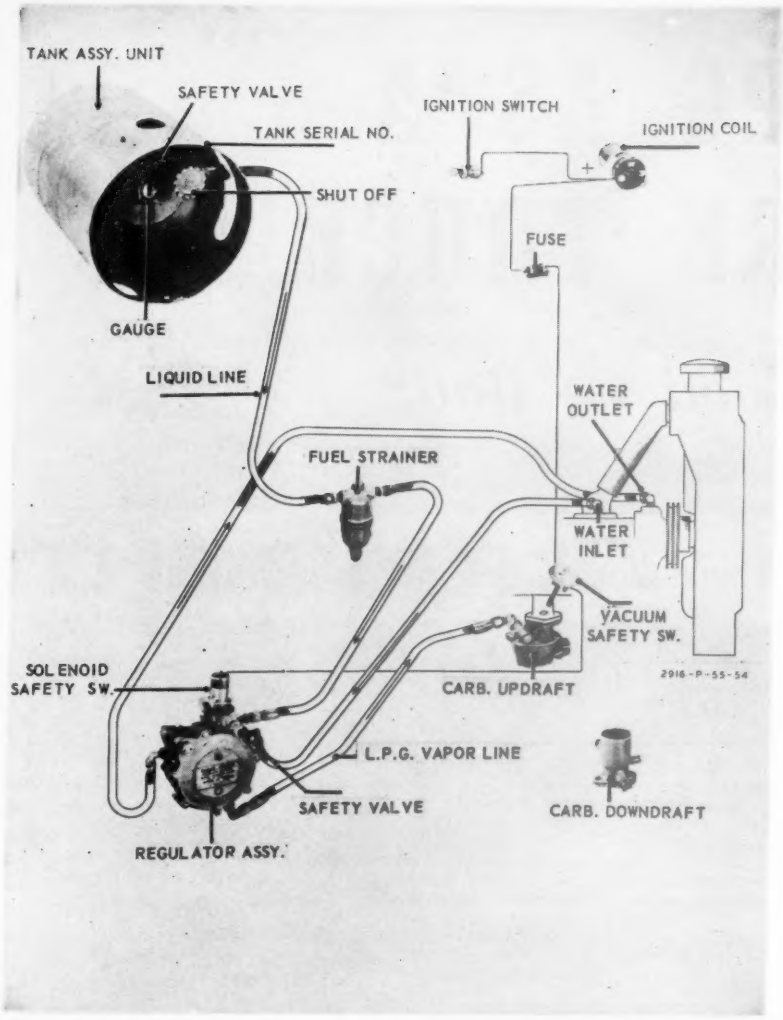
—LPG enters the combustion chamber as a gas rather than as a vaporized liquid, thus insuring almost complete burning. Unburned carbon deposits, commonly found with gasoline, are almost entirely eliminated.

—LPG's high octane rating allows clean burning, thereby eliminating lead compound deposits in the combustion chamber. LPG is completely free of materials that cause varnish deposits.

—Since LPG is a dry gas, there is no liquid to wash down the cylinder wall lubricant. Crankcase dilution is virtually eliminated. This results in less wear on cylinder walls and bearings and longer life for lubricating oils.

—The simple carburetor has

*Chief Engineer, Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich.



Above sketch illustrates the simple fuel system of fork truck engine powered by liquefied gas. Main components are the high pressure tank, vaporizer-regulator and the downdraft carburetor.

no jets or other mechanisms that require maintenance and adjustments usually necessary with a gasoline carburetor.

—The fuel pump is eliminated because LPG is under its own pressure in the tank.

In most installations lowered fuel costs are realized with LPG but this largely, depends on geographic location. Generally speaking, LPG costs less than gasoline in the western, mid-western, north-central and Gulf states. In the north-eastern states, LPG is usually more expensive. In the former areas lower fuel costs will reflect especially substantial savings in fleet installations where fuel costs make up a large portion of the total operating cost.

Buying LPG in bulk rather than individual tanks increases savings in the cost of fuel, but necessitates the purchase and installation of storage facilities. Whether such action is economical depends on total fuel consumption.

What About Fumes?

The small amount of fumes produced by LPG combustion are colorless, odorless and harmless—a factor which can be of considerable importance in certain instances. Because of the almost complete burning of the fuel, exhaust fumes are produced to a much less extent than with gasoline engines. Carbon monoxide, the most harmful ingredient in gasoline engine exhaust fumes, is contained in LPG fumes in only minute amounts due to the high volatility of LPG. For the same reason, odorous aldehydes—which give gasoline fumes their obnoxious smell—are nonexistent to any traceable degree in LPG fumes.

Is LPG Safe?

Much has been said, and misunderstood, concerning the safety of using liquefied petroleum gas. Its characteristic high volatility, and the fact that it must be kept under high pressure, have occasioned some misgivings about the

Clark Equipment Company's, newest model, the Clarklift 30, operates on a factory-installed LPG system.

possibility of explosions and other accidents. In some cases these doubts have been strong enough to decide against use of LPG.

There is an "accident potential" in any fuel, LPG not excepted. But experience has proven beyond question that there is no more danger in use of LPG than there is with gasoline, or even diesel fuel, when normal safeguards and good maintenance procedures are utilized.

Well-engineered components are essential for safety. Fuel containers must comply with local regulations concerning the use of LPG. The tank should be equipped with a safety-relief valve which by-passes excess pressure and it is mandatory to have on the tank an excess flow valve which automatically shuts off the flow of gas if the flow is too fast, which might occur if a coupling or hose is broken. Fuel systems should be completely sealed to eliminate fuel leakage or evaporation. Quick-disconnect, self-sealing couplers are important in that they help prevent gas leakage during tank change-overs.

Since LPG is an odorless gas, LPG manufacturers add an odorant to aid in the detection of gas leaks. Often this odor is found in the exhaust fumes and is ignored because it is considered natural. This is a mistake. Odorous exhaust fumes indicate that the odorant is not being burned completely, probably because the fuel mixture is too rich. This should be corrected immediately, not only for more efficient engine operation, but also because the fume odor might prevent detection of a similar odor resulting from a gas leak from the tank or hose couplings.

While a gas leak is potentially dangerous, by no means does it indicate an imminent explosion. To illustrate, let us assume that a tank valve has been damaged, resulting in a slow, steady leakage of gas. Ordinarily the leak would be detected either by the odor or by the sound made by the escaping gas. But in this case the leak has not been noticed, and an open flame is accidently directed to the gas flow.

The result would be not an explosion but a tongue of flame extending out from the valve, much like an acetylene torch. Length of the flame would depend on the pressure behind the gas leak. While the flame itself might cause damage or injury, there would be no explosion damage.

Such a leak might result in an explosion if the leak were undetected long enough for a sizeable amount of gas to collect in a closed, unventilated area, such as the bottom of an elevator shaft, and then be ignited. While such a situation is possible, it is highly improbable if the LPG equipment being used is well constructed and in good repair.

Some gas usually escapes when fuel tanks are changed, but even this harmless amount can be reduced or eliminated with proper techniques. The shut-off valve on the tank should be completely closed during this operation. After the valve is shut, the fork truck engine should be run till it stops, thus using all fuel remaining in the fuel system. This relieves pressure on connecting hoses leading from tank to metering device. If this procedure is followed correctly, there will be no "phfft" of escaping gas when the tank is removed.[1]

The small amount of exhaust fumes produced by liquefied petroleum gas are colorless. odorless, and harmless. This characteristic makes LPG advantageous fuel for fork trucks handling chemicals and other products which might be damaged by gasoline fumes.

Most communities have local ordinances governing the use of LPG, and the first-time user of this fuel should consult these rulings to make sure his LPG operation is within regulations. Usually these codes demand that LPG be stored in an open area away from general plant activity —a restriction often placed on fuels or other flammable materials.[2]

Factory-Built or Conversion

Some fork truck owners may not know that it is not necessary to purchase a machine factory-built for LPG operation to gain the advantages of this fuel. Most fork trucks now using gasoline can be converted to LPG operation at a reasonable cost. Clark, for example, has made available to its dealers a kit for shop-conversion to LPG of all standard Clipper, Carloader, Yardlift 40 and Utili-

(1) Two types of quick-disconnect couplers recently developed eliminate the need for running the engine overtime, and also do away with the "phfft".

(2) For more information about codes governing storage of LPG refer to National Fire Protection Association pamphlets #58 and #59, and A.S.M.E. Boiler Construction Code, Section VIII. Also see I.C.C. regulations.

Individual LPG tanks are filled in a shed next to the bulk storage tank. A device on the scale shown here automatically shuts off the flow of gas when weight of tank reaches 33½-lbs. net. LPG is measured in pounds; 4.46 pounds equal one gallon of gasoline.

truc model fork trucks. While some owners have purchased the kits to make conversions in their own shops, most prefer that the work be handled by the fork truck dealer because of the complexity of the job. Owners of large fleets of fork trucks planning conversion to LPG will find it advantageous to have their own mechanics learn how to make conversions.

Successful conversion depends on good workmanship and quality parts, so the fork truck owner will be wise to insist on these requisites. Minimum conversions or short kit "spud-ins" not widely recognized or approved, or their components, should be avoided. All components used in conversion should have *Underwriters' Laboratories* approval if the user hopes to obtain reasonable insurance rates. (When converting fork trucks to LPG, it's wise to inform the fire insurance company to make sure that use of LPG does not alter insurance rates.)

Conversions of fork trucks to LPG should be made only on engines in top-notch shape. It is especially important that pistons, rings, valves and cylinder head are clean and free of carbon deposits. Gasoline, which causes carbon deposits, also acts as a solvent in keeping the deposits from becoming highly abrasive. LPG does not have this solvent effect, but tends to harden the residual carbon into a very abrasive substance. Therefore a good overhaul, or at least a thorough cleaning, is a necessary preparation for a proper conversion. For this reason a conversion usually will be done most economically at a time when the fork truck is normally due for an overhaul.

Since LPG, because of its high flame temperature, has a tendency to burn conventional valves, it is advisable to install stellite-faced valves and seats and positive valve rotators in the converted engine.

	Industrial Tugs		Fork-Lift Trucks	
Per Engine Hour	**Propane**	**Gasoline**	**Propane**	**Gasoline**
Gallons of fuel	0.471	0.485	1.046	0.776
Fuel cost	$0.333	$0.086	$0.073	$0.138
Fuel and combustion system maintenance cost	$0.007	$0.015	$0.010	$0.030
Total cost	$0.040	$0.101	$0.083	$0.168
Saving	$0.061	....	$0.085	....

Table I

Where Can LPG Be Used?

A common misconception concerning use of LPG powered fork trucks is that they are applicable only in very specific or specialized situations—situations in which gasoline or electric-powered trucks are not practical for some reason.

The truth is that today LPG is being used as a fuel in every industry in which fork trucks are utilized.

The fumeless characteristics of LPG, of course, make it an especially valuable fuel in certain industries, notably the food processing and canning industries. But the combined advantages of LPG make it a fork truck fuel that can be utilized in any installation, a fact proved by the experiences of LPG users in a wide variety of applications.

For example, the Douglas Aircraft Company, Santa Monica, Calif., recently published the results of a test made to determine the comparative advantages of Propane and gasoline as fuels for fork trucks and towing tractors used in the plant. Using four Clark towing tractors and two fork trucks as a test group, the company operated half the machines on LPG

(*Turn to page 84*)

SURFACE AVAILABILITY OF INHIBITORS IN PROTECTIVE COATING SYSTEMS

*Part II—Chromate Pigmentation of Organic Coatings**

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The corrosion inhibiting chromate matter in organic coating systems can be incorporated in the organic vehicle by the use of metal or alkali metal chromates. The effect of these chromates is dependent on the degree to which they become available in this particular type of pigmentation. These characteristics have been studied and measured by a new method which consists of providing a layer system of a supporting cellulose acetate base to which a methyl cellulose layer is applied containing inorganic matter that changes its color when in contact with chromate ions. The surface of this layer is sealed with a clear lacquer.

On top of this lacquer a second layer is applied. This second layer contains the chromate material. This surface is sealed with a clear lacquer film.

This layer system is immersed in distilled water; and the color changes caused by the carrying of chromate ions from the top layer through the sealing lacquer film into the bottom layer, containing the indicator, is measured by determining the tristimulus values at certain time intervals and calculating from them the color change value.

The rate of chromate migration depends on the water-solubility of the chromate and on the water-resistance of the organic vehicle. Studies have been made with soluble alkali chromates and with zinc and strontium chromate. The vehicles were methyl cellulose solution, organic lacquer and a phenolic varnish.

THIS paper is concerned with the study of organic coatings as the source of chromate ions, which are considered inhibitors in protective coatings systems.

It presents a new method for the activity of chromate ions, based on the measurement of the migration of the chromate matter which is released from chromate salts when in contact with water or moisture, and carried through the coating system by water or moisture to the substratum to which the system has been applied.

Using this method, it is shown that the amount of freed chromate ions depends: a) on the water solubility of the chromate matter, and b) on the selection of the organic vehicle in which the chromate matter has been dispersed.

It also shows that a soluble alkali chromate dispersed in methyl cellulose-water coating will, under the limited amount of moisture reaching the system through an organic lacquer sealer, release considerably more chromate matter than a zinc chromate or a strontium chromate dispersed in the same methyl cellulose coating. But the same zinc chromate or strontium chromate, when dispersed in an organic vehicle such as phenolic-oil varnish, released considerably less chromate matter. In these particular cases the amount of free chromate matter has been found to be extremely low regardless of the water solubility of the pigment material. It was greater when alkyd modified nitrocellulose lacquer was used as the organic medium.

The Test Method

The test method utilizes the color change in a base layer which occurs under permeation of a lacquer film and applies it to the problem of inhibitor permeation. It uses new color indicators and develops a quantitative method for evaluating color changes.

As color indicators, materials were selected which are colorless and water soluble but which become colored in contact with chromate ions. The progress

*The work in this paper was carried out under a development contract with the U. S. Navy, Bureau of Aeronautics.
This paper was presented at the Meeting in Minature of the New York Section of the American Chemical Society on March 16, 1956.

of the color development, with progressing chromate contact, can then be measured; and the change which occurs during the test can be calculated from these individual measurements. The results can then be expressed as 'progress of color change' versus 'time of immersion'.

Methyl cellulose solutions were used for incorporating the color indicator and, in some of the test groups, for the incorporation of the source of the chromate ions also. The indicator layer and the chromate source layer were separated by a clear lacquer film (MIL-L-7178) and the lacquer was also applied on top of the system as a protective coating during handling.

All layers were applied on a plastic film base (cellulose acetate) to secure a transparent system which has a low weight and is easy to handle.

Since the source of the chromate ions also has some color generally, the color change was compared with a film system of the same composition but without a color indicator. This control specimen was called a blank.

As color indicators either colorless mercurous nitrate, which changes into brown-red mercurous chromate (Series P7-18), or blue copper nitrate ($Cu(NO_3)_2$), which changes into the basic chromate and turns to yellow-brown were used.

Preparation of the Test Specimens

A system of films was built up as follows:

a) A cellulose acetate sheet was used as a transparent base layer.

b) A solution was prepared of 5 grams methylcellulose (1500 cps.) in 125 g. water.

c) A saturated solution of mercurous nitrate (Hg-NO-.H-O) was prepared in 25 grams of water and was added to the methylcellulose solution. (It is to be considered that the mercurous salt is being hydrolyzed.)

d) A coating of the solutions of b and c was applied to the cellulose acetate sheet and allowed to dry. This was selected because the mercurous nitrate is a white material and the mercurous chromate is red-brown. By so inclosing the mercurous nitrate in methylcellulose and separating this layer from a source of chromate ions by a dry lacquer film, a film penetration of the chromate ions through the lacquer film occurs when there is the appearance of red-brown mercurous chromate, which can be observed through the transparent film of cellulose acetate.

e) A coating of a clear lacquer was applied on the dry methylcellulose film. The lacquer was an alkyd modified nitrocellulose lacquer plasticized with tricresylphosphate in accordance with Spec. MIL-L-7178. (The alkyd was a cocoanut fatty acid-type.) The thickness of each layer is given in the Tables.

f) Another methylcellulose solution was prepared as under Pos. b. and the chromate to be tested was added to this solution.
This methylcellulose medium was used in two test groups, as a source of chromate ion in each case:

1. a soluble chromate, such as potassium chromate, by dissolving 4 grams potassium chromate in a solution of 5 g. methylcellulose (1500 cps.) with 150 grams water, or
2. As a chromate pigment, such as dispersions of 2 grams of strontium chromate or 2.5 g. zinc chromate or basic zinc chromate in 25 g. distilled water and added to a solution of 2.5 g. methylcellulose (1500 cps.) in 50 grams water.

In the later test group this pigment dispersion in methylcellulose was replaced either by a layer of the pigment in a phenolic varnish, based on a non-heat-reactive, oil soluble, butyl-phenolic resin with 15 gal. of dehydrated castor oil, or by a layer of the pigments in the same alkyd modified nitrocellulose lacquer used as a sealer film under Pos. e.

g) A protective film of the clear lacquer of Pos. e was applied.

The Test Set-Up

Figure 1 shows a schematic drawing of the test

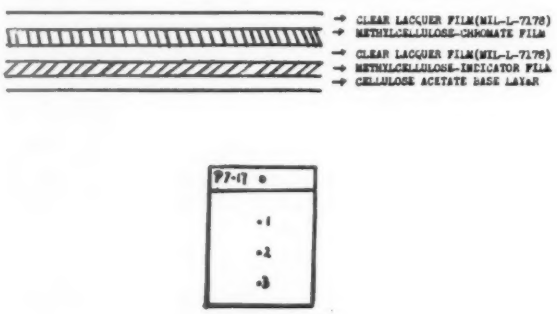


Figure 1
Top: Test Layer System.
Bottom: Test layer panel showing reference points in test measurements.

layer system and gives the location of the three reference points which were used in the measurements.

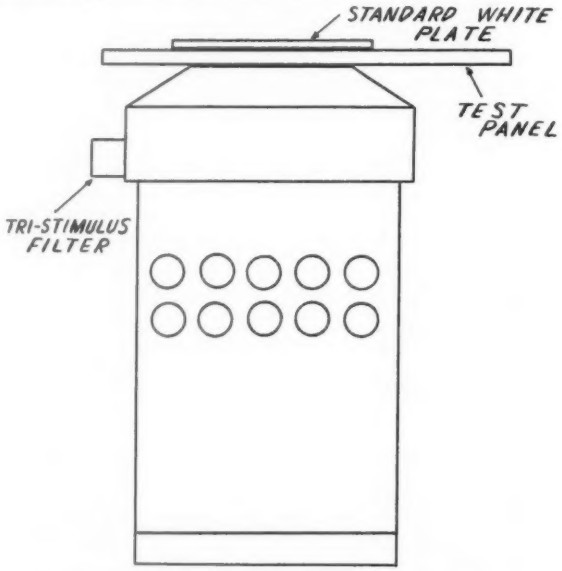


Figure 2. Photovolt Standard Search Unit

Figure 2 shows the instrumental set-up for the color-change measurements. In application, the specimens were placed on the sensitive cell of the instrument and the standard white enamel panel of the instrument was used as backing for the specimens. This standard was used as backing in all measure.

ments to assure more accurate readings of the color changes.

Color Changes

A. Tri-stimulus values were determined for each of the three reference points #1, #2 and #3, using the Photovolt Photoelectric Reflection Meter, Model 610, with three filters: a) Value x was determined with the tri-amber filter, b) Value y was determined with the tri-green filter, c) Value z was determined with the tri-blue filter.

B. For control purposes each series was made with a four layer panel and with a blank where the color variations were studied without the use of the mercurous nitrate indicator. This panel is made by applying to the plastic base first the chromate layer and then the lacquer, the purpose being to eliminate from the measurements any discoloration caused by any reason other than by the indicator such as lacquer discoloration when immersed in water.

C. The panels were immersed in distilled water.

D. New x, y, z readings were taken at time intervals as listed in the various Tables.

E. Visual observations were recorded.

F. The test group with soluble chromate was continued for 78 hours immersion time. The test group with chromate pigment was tested for a longer immersion time because of the slow color changes under the immersion.

G. The change in color caused by the entering of chromate ions into the mercurous nitrate layer was determined using method #623.1 of Fed. Spec. TT-P-141b. This method uses instead of the terms x, y, z the following:

"A" for readings with the tri-amber filter (x).
"G" for readings with the tri-green filter (y).
"B" for readings with the tri-blue filter (z).

From these values, the method determines the values a, b and L, using the equations shown in Table 1.

a) FROM THE READINGS WITH THE AMBER FILTER (A), THE GREEN FILTER (G), AND THE BLUE FILTER (B), THE THREE FACTOR L, a, b ARE CALCULATED FOR EACH OF THE TEST PERIODS UNDER COMPARISON:

$$a = \frac{70\sqrt{G}\cdot A - G}{A + 2G + B}$$

$$b = \frac{70\sqrt{B}\cdot [0.4(G-B)]}{A + 2G + B}$$

$$L = 10\sqrt{G}$$

b) FROM THESE FACTORS FOR THE INITIAL PERIOD o AND THE TEST PERIOD t THE COLOR CHANGE VALUE IS CALCULATED FOR THAT INTERVAL:

$$CD = \sqrt{(L_t - L_o)^2 + (a_t - a_o)^2 + (b_t - b_o)^2}$$

Table 1. Calculation of color difference CD from the measurements of the apparent reflectance with a tri-stimulus reflectometer.

From the a, b and L values, the method determines the color change or color difference using equation b) shown in Table 1.

In the present studies, the a, b, L values were calculated in each case for the state O (before water immersion) and for each time interval in which the x, y, z readings were taken (time interval t). Hereby, the Color Change or CD (color difference) was calculated for each time interval.

For the different test groups of this paper, the x, y, z readings, the resulting a, b, L values and the CD values are shown in the Tables provided for each group. In several cases the 'color change' is plotted versus 'time of immersion' and this is shown in the Figures to these groups. In these cases the 'color change' versus 'time' curve is shown for the test layer panel as well as for the blank, that is, the control panel where a methylcellulose layer without indicator is applied to the cellulose acetate base. In some cases the net change is also shown, as calculated for the various time intervals, as the difference between the curve point for the test specimen and that for the blank.

Studying Soluble Chromate

The method described has been applied to the study of the migration of soluble potassium chromate through a clear lacquer film (MIL-L-7178).

The thickness of the film layers for each panel is shown in Table 2.

	FILM THICKNESS (mils)				
	#1	#2	#3	#4	BLANK
PLASTIC BASE	3.3	3.4	3.4	3.5	3.4
METHYLCELLULOSE-MERCUROUS NITRATE	0.8	0.6	0.9	1.0	-
CLEAR LACQUER	1.9	1.9	1.7	1.8	-
METHYLCELLULOSE-POTASSIUM CHROMATE	0.8	0.6	0.6	0.8	0.7
CLEAR LACQUER TOP FILM	1.3	1.4	1.4	1.8	1.7
TOTAL THICKNESS OF TEST PANELS:	7.8 mil.	7.9 mil.	8.0 mil.	8.4 mil.	8.8 mil.

Table 2. Film thickness of layers in test panels for the chromate migration derived from potassium chromate using mercurous nitrate as indicator. Test series P7-18.

The color changes were determined by measuring the tri-stimulus values x, y, z for the color appearance, using a constant method of measurement at certain time intervals from 0 hrs. to 78 hrs. of immersion in water. These data are given in Table 3. The visual observations are shown in Table 4.

THE TRISTIMULUS READINGS OF THE PANELS (AVERAGE OF THREE TEST POINTS)

PANEL #	FILTER VALUE:	IMMERSION TIME IN HOURS 0	2.5	5	8	11	14	17	20	24	26
1	x	67.7	60.3	59.2	56.8	56.8	55.3	54.7	54.3	53.0	52.7
	y	62.8	54.0	51.8	50.8	49.0	48.8	47.0	47.5	45.5	45.5
	z	17.2	11.5	11.0	11.8	9.8	10.7	9.7	10.0	9.5	9.7
2	x	69.2	62.0	61.7	59.2	59.8	58.0	57.7	57.0	56.0	55.7
	y	65.2	56.5	54.7	53.8	52.3	51.7	50.7	50.3	48.8	49.0
	z	20.0	13.2	12.3	12.7	11.0	11.8	10.2	11.3	10.5	10.5
3	x	70.7	62.5	61.0	57.8	58.2	55.5	56.2	53.5	51.8	51.0
	y	66.8	56.2	53.2	50.2	50.2	47.7	47.8	46.2	42.7	43.2
	z	18.7	11.3	10.8	9.7	9.5	8.7	9.0	8.2	7.7	7.3
4	x	71.0	61.8	59.7	57.3	56.8	54.8	54.3	52.2	49.7	48.8
	y	64.7	54.7	52.0	50.0	49.0	46.8	46.3	44.7	41.8	41.3
	z	19.7	12.7	11.8	10.0	10.0	9.0	9.0	8.8	8.0	8.0
BLANK	x	68.7	65.3	64.3	62.3	61.3	61.3	61.0	60.3	59.5	59.5
	y	65.2	61.8	59.3	57.8	55.7	55.2	54.8	54.7	53.2	53.2
	z	22.8	17.8	17.2	16.7	15.3	14.8	14.8	14.5	14.5	14.3

PANEL #	FILTER VALUE:	IMMERSION TIME IN HOURS 30	34	39	44	50	68	73	78
1	x	51.2	51.0	50.2	49.7	49.0	51.0	52.7	48.2
	y	44.0	42.7	42.5	41.7	41.2	44.7	45.2	40.0
	z	8.3	8.2	8.0	8.0	8.0	9.3	10.3	8.2
2	x	51.0	54.3	53.5	53.0	53.0	55.7	56.7	52.5
	y	47.8	47.0	46.7	45.8	45.7	49.7	50.5	44.5
	z	9.7	9.5	9.5	9.3	9.3	12.8	13.5	11.0
3	x	50.2	48.8	48.2	47.2	46.8	47.2	47.7	50.3
	y	41.0	40.2	39.7	38.8	38.3	39.7	40.2	41.7
	z	7.0	6.7	6.3	6.3	6.2	6.3	6.2	9.2
4	x	47.7	47.2	45.8	44.7	44.2	42.3	41.8	38.8
	y	40.0	39.0	38.5	36.7	36.5	37.3	35.5	20.7
	z	7.2	6.8	6.7	6.7	6.5	6.5	5.8	3.5
BLANK	x	59.5	59.3	59.0	58.5	58.7	60.3	60.5	58.8
	y	52.5	52.5	52.7	52.7	52.7	56.0	56.2	54.2
	z	15.7	15.5	14.7	13.5	13.7	17.8	19.0	16.3

Table 3. Test Series P7-18: The chromate migration derived from potassium chromate studied using mercurous nitrate as indicator.

TEST SERIES P7-18.

After 2.5 hrs. water immersion the BLANK showed evidence of local wash-out and the solution was tinted yellow.

After 8 hrs. immersion Panel #2 showed at the top two washed-out areas which might affect later readings on Reference Point #1.

After 14 hrs. immersion, Panel #3 had a few, small, plainly visible, orange spots.

After 26 hrs. immersion, all panels had small, plainly visible, orange spots.

After 44 hrs. the BLANK had many more washed-out areas.

After 50 hrs., Panel #4 showed 3 instances of edge seepage.

After 68 hrs., Panel #4 showed water between the plastic base and the first layer from edge seepage. The color was brownish red. There were additional, larger, orange blisters on the panels.

At 72 hrs., increased washed-out areas appeared. A whitish appearance of the panels was observed.

Table 4. Visual observations during immersion test.

From these measurements the values for the color change, are calculated in accordance with Method 623.1 of Federal Spec. TT-P-141b.- These values are given in Table 5.

PANEL:	THE BLANK			PANEL			PANEL		
HRS. OF	(WITHOUT INDICATOR)			#1			#2		
IMMERSION	a	b	L	a	b	L	a	b	L
0	8.7	49.5	80.0	12.9	47.9	79.2	10.3	46.6	80.8
2.5	10.1	46.6	78.5	18.0	48.7	73.5	18.1	48.0	75.2
5	13.5	45.3	77.2	21.5	49.2	72.0	19.8	47.8	74.0
8	15.0	44.7	76.0	17.6	45.7	71.3	15.4	46.9	73.3
11	15.6	45.0	74.7	23.2	46.7	70.0	21.7	47.8	72.4
14	17.0	45.2	74.3	19.3	45.6	69.9	18.3	46.3	71.8
17	17.3	44.7	74.1	23.1	45.2	68.6	20.6	47.6	71.2
20	15.8	45.0	74.0	20.6	45.4	69.0	19.7	46.0	71.0
24	17.8	43.8	73.0	23.1	44.3	67.5	21.5	46.7	69.9
26	17.9	44.3	73.0	22.8	43.8	67.3	20.0	45.9	70.0
30	17.1	45.3	73.2	22.6	45.0	66.3	21.8	45.7	69.2
34	16.5	45.6	73.2	26.3	43.7	65.3	22.2	40.8	68.6
39	17.9	44.2	72.6	24.6	44.1	65.3	20.8	45.5	68.4
44	16.6	44.9	72.5	25.6	43.2	64.6	22.2	45.0	67.7
50	17.2	44.7	72.6	25.2	42.8	64.2	22.2	44.8	67.6

PANEL:	PANEL #3			PANEL #4		
HRS.	a	b	L	a	b	L
0	12.6	48.5	81.1	13.6	46.2	80.4
2.5	20.3	49.7	74.5	20.1	48.0	74.0
5	22.3	48.6	73.0	22.2	46.2	72.2
8	22.4	47.9	70.9	21.6	47.1	70.7
11	23.9	48.0	71.0	23.2	46.4	70.0
14	23.7	47.4	69.0	24.3	43.6	68.5
17	25.3	46.8	69.2	24.4	45.7	68.1
20	22.5	46.9	68.0	23.3	44.7	66.8
24	25.6	45.5	66.2	25.3	43.3	64.7
26	26.6	49.1	65.7	24.2	43.0	64.3
30	26.4	45.2	64.8	25.2	43.1	63.3
34	28.2	43.8	63.4	27.2	42.7	62.5
39	28.0	44.1	63.0	24.5	42.7	62.1
44	27.9	43.2	62.3	27.2	40.8	60.6
50	28.4	44.2	61.8	26.7	41.0	60.4

Table 5. Test series P7-18: The calculated values a, b, L for the calculation of the color changes according to the method #623.1 (TT-P-141b).

From these values the color changes themselves are calculated. These are shown in Table 6. These values are plotted as 'Color Difference' versus 'Hours of Immersion' in Figures 3, 4, 5 and 6. The values are shown in Table 7.

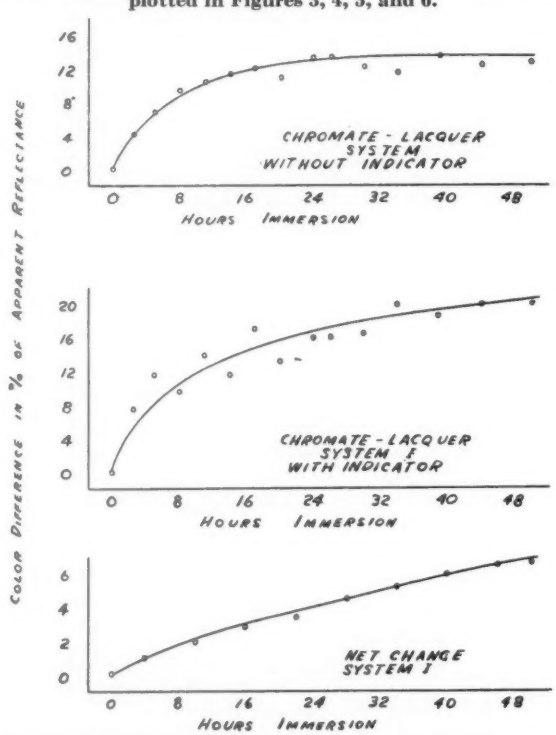
These graphs show how these values compare with those taken on the blanks, and therefore they show the 'net values' of the color changes. The results indicate that:

(1). The equation for calculating the color change is based on R. S. Hunter, National Bureau of Standards Circular C-429 (July 20, 1943).
Scofield, Judd and Hunter, ASTM Bulletin, May 1941, page 19.
Scofield, Circular of the Scientific Section, National Paint, Varnish and Lacquer Assoc., #664, July 1943.

$$CD_t = \sqrt{(L_t - L_0)^2 + (a_t - a_0)^2 + (b_t - b_0)^2}$$

TIME HRS.	BLANK WITHOUT INDICATOR CD_t	PANEL #1 CD_t	PANEL #2 CD_t	PANEL #3 CD_t	PANEL #4 CD_t
0	0	0	0	0	0
2.5	4.0	7.7	9.7	10.2	9.3
5	7.4	11.3	11.7	12.5	11.8
8	9.3	9.5	9.1	14.1	12.6
11	10.3	13.8	14.2	15.1	14.1
14	11.4	11.5	12.0	16.4	16.2
17	12.0	17.0	14.1	17.5	16.4
20	10.9	13.0	13.6	16.5	16.8
24	13.3	15.9	16.3	20.0	19.8
26	13.2	16.0	14.5	20.8	19.5
30	12.1	16.4	16.4	21.6	20.9
34	11.6	19.8	18.0	24.0	22.7
39	13.5	18.6	16.3	24.2	21.6
44	12.4	19.9	17.8	24.8	25.1
50	12.8	20.0	17.9	25.3	24.5

Table 6. Test Series P7-18: The color differences from the equation. Panels #3 and #4 gave the clearest results, but 31 and 32 follow same development pattern. Data are plotted in Figures 3, 4, 5, and 6.



Migration of the chromate ion. Alkali chromate with methyl cellulose as vehicle.

a) the chromate ions penetrate into and through the clear lacquer film;

b) this migration continued throughout the test time although the color changes decreased in rate after an initial period.

Studying Chromate Pigments

Having shown that water soluble chromates in a methylcellulose film supply chromate ions which migrate with the penetration of moisture through the

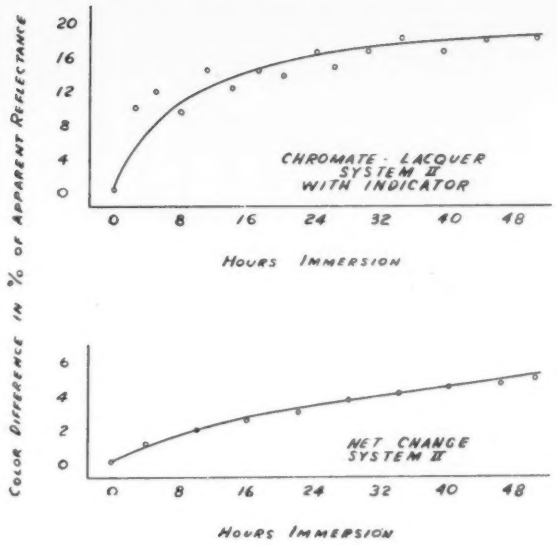


Figure 4. Migration of the chromate ion. Alkali chromate with methyl cellulose as vehicle.

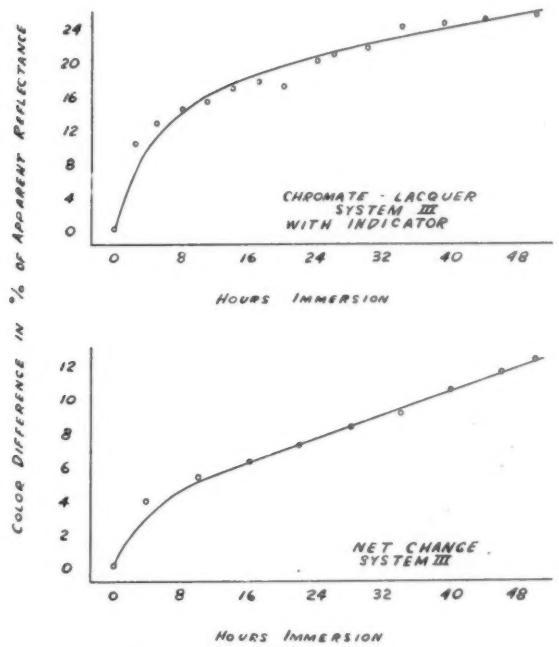


Figure 5. Migration of the chromate ion. Alkali chromate with methyl cellulose as vehicle.

organic coating system, the study was extended to dispersions of zinc chromate, basic zinc chromate and strontium chromate in the same methyl-cellulose system.

These metal chromates have a limited water solubility, which differ for various chromate pigments. Therefore, the passage of water through them will yield less chromate ions per unit volume than will the use of the soluble chromates.

Because of this low water solubility, if water is passed through two different layers, one being readily soluble and the other having limited solubility, the layer of the less soluble chromate will last much

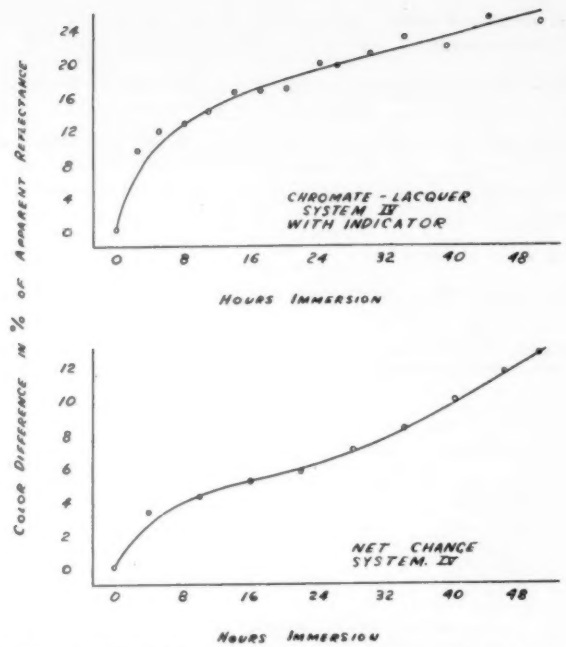


Figure 6. Migration of the chromate ion. Alkali chromate with methyl cellulose as vehicle.

IMMERSION HRS.	BLANK READING	PANEL #1 READING	PANEL #1 DIFF.	PANEL #2 READING	PANEL #2 DIFF.	PANEL #3 READING	PANEL #3 DIFF.	PANEL #4 READING	PANEL #4 DIFF.
4	6.0	7.0	1.0	7.0	1.0	9.8	3.8	9.2	3.2
10	10.0	12.0	2.0	11.8	1.8	15.2	5.2	14.2	4.2
16	11.8	14.6	2.8	14.2	2.4	18.0	6.2	16.9	5.1
22	12.9	16.3	3.4	15.8	2.9	20.0	7.1	18.5	5.6
28	13.3	17.8	4.5	16.9	3.6	21.5	8.2	20.2	6.9
34	13.6	18.8	5.2	17.6	4.0	22.6	9.0	21.8	8.2
40	13.6	19.5	5.9	17.9	4.3	24.0	10.4	23.5	9.9
46	13.6	20.1	6.5	18.2	4.6	25.0	11.4	25.1	11.5
50	13.6	20.2	6.6	18.5	4.9	25.8	12.2	26.2	12.6

Table 7. Test Series P7-18: Comparison between the blank and the four panels: The "Net Change" calculated as the difference between the points on the color change graphs for panels #1, #2, #3, #4 and the blank.

Note: This calculation uses the points on the drawn color difference curves. These are recorded in the "Readings" columns. The "Difference" columns give the difference between the readings in the "Blank" column and those four panels as the "Net Change" in Figure 3-6.

longer. Therefore, it was of interest to study how much and how long these layers will supply chromate ions into the test system.

The chromate pigments were dispersed in a water solution of methylcellulose, and this dispersion was applied as previously above an indicator layer and then sealed with a lacquer film. The composition of the various dispersions was given earlier in the part of this paper describing test procedure.

Two series of tests were made: P7-40 and P7-50. The preparation of these test panels is shown in Tables 8 and 9. The results are further tabulated in Tables 10, 11 and 12. The data are plotted in Figures 7, 8 and 9.

In comparing the color change for the same chromates in different test series, it is to be noted that in Figure 6 the curve for Panel P7-40-1 is higher in percent of discoloration than in the corresponding Panel P7-50-3 because, according to the Tables of preparation, the indicator film on P7-40-1 had a thickness of 0.9 mil and P7-50-3 had a thickness of 0.8 mil. That means that there was slightly more indicator available for the color change. This shows the sensitivity of the method. This is also the case in Figure 8 where the curve for P7-40-3 is slightly higher than for P7-50-2, because here panel P7-40-3

1) METHYLCELLULOSE SOLUTION: 2.5g Methylcellulose 1500 cps and 50g water

2) INDICATOR SOLUTION: 50g water with 2.5g Methylcellulose 1500 cps and 25g water with 1.5g Mercurous Nitrate

3) DISPERSION OF A ZINC CHROMATE OF A MEDIUM CONTENT IN SOLUBLE MATTER (FED. SPEC. TT-P-415 TYPE II) (IMPERIAL COLOR #683)
50g water and 2.5g Methylcellulose 1500 cps and 25g water and 2.5g pigment.

4) DISPERSION OF A STRONTIUM CHROMATE (48-49% SrO, 45-46% CrO_3) (KENTUCKY COLOR #2396)
50g water and 2.5g Methylcellulose 1500 cps and 25g water and 2.0g pigment

5) DISPERSION OF A BASIC ZINC CHROMATE (71% ZnO, 15.9% CrO_3) acc. SPEC.MIL-C-15328 A) (IMPERIAL COLOR #2289)
50g water with 2.5g Methylcellulose 1500 cps and 25g water with 2.5g pigment.

6) SOLUTION OF POTASSIUM CHROMATE:
150g water with 5g Methylcellulose and 5g K_2CrO_4

7) LACQUER: ALKYD MODIFIED NITROCELLULOSE LACQUER MIL-L-7178 (UNIVERSAL COATINGS #0-10)

Table 8. Solutions used for the comparison of different chromate pigments with potassium chromate in methyl-cellulose dispersions.

SERIES P7-40 PANEL #	1 AND 3 WITH SOLUTION #3: (ZINC CHROMATE)	#2 WITH SOLUTION #4: (STRONTIUM CHROMATE)	#5 WITH SOLUTION #5 (BASIC ZINC CHROMATE)	#4 WITH SOLUTION #6 (POTASSIUM CHROMATE)
PREPARATION OF PANELS (THICKNESS IN MIL)				
PLASTIC SHEET: METHYLCELLULOSE SOLUTION #1	4.1	4.1	4.2	4.0
METHYLCELLULOSE SOLUTION #2 (INDICATOR)	0.9	0.9	0.8	0.6
LACQUER, APPLIED IN 3 THIN COATS	4.8	4.8	4.2	5.2
CHROMATE DISPERSIONS	0.7	1.0	0.3	0.2
TOP LACQUER FILM	4.0	2.5	4.0	3.3
	-	0.7 (BLANK)	-	-
	2.5			2.5

EDGES OF PANELS TRIMMED AND TAPED. READINGS TAKEN "BACK-DOWN" WITH PANELS BACKED BY A WHITE STANDARD, 77.5%

SERIES P7-50 PANEL	#1 and 4 WITH SOLUTION #4 (STRONTIUM CHROMATE)	#2 and 5 WITH SOLUTION #5 (BASIC ZINC CHROMATE)	#3 WITH SOLUTION #3 (ZINC CHROMATE)
PLASTIC SHEET	4.3	4.2	4.1
METHYLCELLULOSE SOLUTION #1(BLANK)	-	0.3	-
METHYLCELLULOSE SOLUTION #2 (INDICATOR)	0.8	0.4	0.8
LACQUER, APPLIED IN 3 THIN COATS	4.4	3.8	3.8
CHROMATE DISPERSIONS	0.8	1.6	1.3
TOP LACQUER	2.2	3.0	2.7
	-	0.5	-
	4.0	3.3	3.8
	0.7	0.5	1.3
	2.5	2.7	1.0

EDGES OF PANELS TRIMMED AND TAPED.

Table 9. Preparation of the test panels of test series P7-40 and P7-50.

PANEL #1: WITH SOLUTION #3 (ZINC CHROMATE #683) AND INDICATOR
#2: WITH SOLUTION #4 (STRONTIUM CHROMATE) AND INDICATOR
#3: WITH SOLUTION #5 (BASIC ZINC CHROMATE) AND INDICATOR
#4: WITH SOLUTION #6 (POTASSIUM CHROMATE) AND INDICATOR
#5: WITH SOLUTION #3 (ZINC CHROMATE #683) WITHOUT INDICATOR ("BLANK")

HOURS OF IMMERSION (AVERAGE OF 3 READINGS) - AGAINST WHITE STANDARD (77.5%)

PANEL #		0	5	8	15	28	34	46	58	64	88	94	112
1	x	69.8	67.3	67.2	66.5	58.7	56.0	54.3	51.0	48.0	46.7	46.3	45.0
	y	66.0	63.8	63.0	61.7	52.2	51.8	50.7	47.2	45.2	43.3	43.3	41.3
	z	11.7	11.8	11.7	11.3	10.5	11.2	10.5	10.0	10.0	10.2	10.3	9.5
2	x	68.5	66.7	66.5	66.3	63.0	62.0	57.7	54.7	55.0	50.8	50.3	47.8
	y	65.8	63.7	63.3	63.5	59.8	58.3	54.3	51.2	49.8	47.7	47.2	45.2
	z	21.5	20.8	21.5	21.0	20.3	19.8	18.2	17.0	16.7	16.5	16.8	16.3
3	x	69.2	68.5	68.2	68.6	66.0	64.7	61.0	54.8	54.3	52.0	51.7	50.3
	y	63.3	62.7	62.8	62.7	60.5	58.8	55.7	50.5	49.5	48.0	46.8	46.2
	z	10.2	10.2	10.3	10.3	11.2	10.8	10.2	9.5	9.8	10.0	10.2	9.8
4	x	63.8	61.5	60.8	59.3	55.7	54.0	51.8	50.3	49.3	48.0	47.2	46.3
	y	60.3	57.5	57.5	56.0	51.2	49.5	47.3	45.8	44.2	42.2	41.8	41.7
	z	23.5	18.0	18.0	20.3	18.5	17.8	18.0	17.0	16.7	16.0	15.7	16.7
5	x	70.8	70.8	70.7	70.8	69.3	69.3	68.7	67.7	67.5	67.3	67.5	66.7
	y	67.5	67.3	66.8	66.8	65.5	64.8	64.7	64.2	63.7	63.2	63.3	62.8
	z	9.3	9.5	9.7	9.3	9.0	9.2	9.3	9.8	9.7	9.0	9.2	9.0

(NOTE: ON PANEL #4 ORANGE BLISTERS APPEARED AFTER 8 HRS. IMMERSION. AN ADDITIONAL STUDY WAS MADE IN SERIES P7-50)

CALCULATION OF THE a, b and L VALUES TO SERIES P7-40

PANEL #		0 HRS.	5	8	15	28	34	46	58	64	88	94	112
1	a	10.1	9.0	11.4	10.4	19.0	12.4	10.8	11.7	8.9	10.9	9.7	5.7
	b	57.8	53.7	55.7	55.3	48.7	47.9	48.2	46.0	44.6	42.5	42.5	42.4
	L	81.3	79.9	79.4	78.5	72.3	72.0	71.2	68.7	67.2	64.8	64.8	64.3
2	a	6.9	7.8	8.3	7.3	8.5	10.0	9.5	10.1	9.3	9.2	9.2	7.9
	b	45.4	44.6	43.5	44.2	42.2	41.5	40.4	39.4	38.6	37.1	36.2	35.2
	L	81.1	79.8	79.7	79.7	77.3	76.4	73.8	71.6	70.6	69.1	68.7	67.2
3	a	16.0	15.7	14.7	15.7	15.1	16.4	15.2	12.9	14.5	12.3	14.7	16.0
	b	57.4	57.1	57.1	56.8	54.2	53.3	52.1	49.3	48.0	46.7	55.0	44.7
	L	79.7	79.2	79.2	79.2	77.8	79.7	74.6	71.1	70.3	69.3	68.4	67.2
4	a	9.2	10.9	9.0	9.0	12.8	13.0	13.2	13.4	15.4	17.8	16.7	14.2
	b	38.6	43.2	43.3	39.1	37.1	36.6	34.3	34.4	33.1	32.1	32.2	30.9
	L	77.7	75.8	75.8	74.8	71.6	70.4	68.8	67.7	66.5	65.0	64.7	64.6
5	a	8.8	9.4	10.4	10.2	10.3	12.2	10.8	9.6	10.4	11.3	11.5	11.6
	b	60.1	61.8	61.0	61.5	61.2	60.1	60.1	60.7	60.4	59.5	59.3	59.1
	L	82.2	82.1	81.7	81.6	81.0	80.5	80.4	80.2	79.8	79.5	79.6	79.1

Table 10. Series P7-40: Water immersion of the test panels.

had an indicator layer 0.8 mil thick and panel P7-50-2 had a thickness of 0.4 mil. The difference was slight between the panels of the third test group, that is P7-40-2 and P7-50-1, because the thickness of the indicator films were more nearly the same.

HOURS OF WATER IMMERSION (AVERAGE OF 3 READINGS)

PANEL #		0	5	8	15	28	34	46	58	64	88	94	112
1	x	64.8	60.7	61.0	59.5	55.2	54.3	52.0	50.5	50.3	49.5	48.5	49.3
	y	62.7	58.7	58.3	56.8	52.0	52.0	48.5	48.8	47.3	47.5	46.8	46.7
	z	20.3	19.2	19.5	19.2	19.0	18.5	17.5	17.3	17.5	18.0	18.0	18.5
2	x	64.7	64.5	64.5	62.8	60.8	60.5	58.7	57.0	57.5	57.7	56.3	56.5
	y	59.3	58.7	58.5	57.7	55.5	55.3	53.5	52.3	51.8	51.8	50.7	51.2
	z	9.7	9.5	9.5	9.8	10.0	10.0	9.3	9.2	9.2	10.0	9.7	9.5
3	x	66.0	63.0	62.0	60.2	57.7	56.5	55.3	53.3	53.2	54.3	52.3	52.2
	y	62.0	58.7	58.2	56.8	53.7	53.2	51.0	50.0	49.0	50.2	48.3	48.3
	z	9.0	9.0	9.0	9.2	9.8	9.8	9.5	9.3	9.2	10.5	9.7	10.7
4	x	71.3	72.0	71.8	71.7	70.8	70.3	70.8	70.0	70.0	70.6	69.5	70.5
	y	68.8	69.3	69.3	69.7	68.7	68.2	68.0	67.7	66.7	67.8	67.2	68.0
	z	20.3	20.5	20.7	20.7	20.7	21.2	20.5	20.8	20.7	21.8	21.2	22.0
5	x	69.7	70.2	70.2	69.5	69.5	68.8	68.8	68.3	68.7	68.8	67.8	68.2
	y	64.0	64.7	64.8	64.2	64.0	63.3	63.2	62.2	62.2	62.0	62.3	62.7
	z	10.5	10.8	10.2	10.3	10.5	10.7	10.0	9.8	10.0	10.0	10.7	10.0

FROM THESE READINGS (SERIES P7-50) AND THOSE OF TABLE 10 (SERIES P7-40) THE COLOR DIFFERENCE WAS CALCULATED

CALCULATION OF THE a, b and L VALUES TO SERIES P7-50

PANEL#		0 HRS.	5	8	15	28	34	46	58	64	88	94	112
1	a	5.5	5.4	7.3	7.4	6.8	6.6	10.2	5.0	8.9	5.9	6.0	7.4
	b	44.6	42.9	42.2	41.2	38.2	38.3	36.1	37.2	35.4	35.1	34.2	33.5
	L	79.2	76.6	76.5	75.3	72.6	72.1	69.7	69.9	68.8	69.0	68.2	68.4
2	a	15.1	16.2	16.8	14.4	15.2	15.0	15.2	14.0	16.9	17.3	16.4	15.8
	b	55.5	55.1	55.0	54.2	52.2	52.2	51.8	51.2	50.3	49.2	51.1	49.7
	L	77.1	76.9	76.5	75.9	74.5	74.5	73.2	73.2	72.4	72.0	71.1	71.8
3	a	11.1	12.2	10.8	9.8	11.7	9.8	12.9	10.0	12.8	12.3	11.6	11.9
	b	58.8	56.3	56.1	54.8	51.6	51.5	49.8	49.6	48.4	47.7	44.6	45.9
	L	78.7	76.6	76.4	75.4	73.2	73.0	71.4	70.7	70.0	70.9	69.5	69.5
4	a	6.3	6.8	6.3	5.0	5.3	5.3	7.1	5.9	8.4	7.6	5.9	6.3
	b	49.2	49.3	49.1	49.4	48.0	50.2	48.3	47.8	46.9	46.4	46.9	46.4
	L	83.0	83.1	83.1	83.5	82.9	82.6	82.5	82.2	81.6	82.3	82.0	82.5
5	a	15.3	14.8	14.5	14.3	14.9	15.2	16.0	17.7	15.7	15.7	15.0	15.0
	b	57.5	58.5	58.6	58.1	57.6	56.9	57.8	57.2	56.8	57.5	56.2	57.4
	L	80.0	80.4	80.5	80.1	80.0	79.6	79.5	78.9	78.9	79.4	79.0	79.2

Table 11. Series P7-50: Comparison of the three chromate pigments of Table 9 in methyl cellulose.

TIME HRS.	ZINC CHROMATE (X683) BLANK: WITH INDICATOR P7-40-5:	P7-40-1:	P7-50-3	BASIC ZINC CHROMATE (X2289) BLANK: WITH INDICATOR P7-50-5:	P7-50-2:	P7-40-3	STRONTIUM CHROMATE (X2396) BLANK: WITH INDICATOR P7-50-4:	P7-50-1:	P7-40-2
5	1.8	4.5	3.5	1.2	1.3	0.7	0.6	3.1	1.8
8	1.9	3.1	3.6	1.5	1.9	1.4	0.3	4.0	2.8
15	2.1	3.8	4.3	1.2	1.9	0.8	1.4	4.5	1.9
28	2.2	16.6	9.1	0.5	4.2	3.8	1.2	9.3	5.2
34	3.8	13.8	9.4	0.8	4.2	3.8	1.5	9.6	5.2
46	2.7	14.0	11.7	0.6	5.4	7.4	1.3	13.6	9.2
58	2.2	17.3	12.2	1.7	6.5	11.0	1.7	11.9	11.7
64	2.9	19.3	13.7	2.7	9.2	13.4	3.4	14.3	12.8
88	3.7	21.8	13.6	0.7	8.4	15.3	3.2	13.9	14.8
94	3.8	21.8	16.9	1.7	7.6	17.6	2.5	15.2	15.6
112	4.3	23.4	15.9	0.8	8.0	17.8	2.8	15.6	17.3

THESE DATA WERE USED TO PLOT THE RATE OF COLOR CHANGE IF % APPARENT REFLECTANCE VERSUS THE HOURS OF IMMERSION.

Table 12. Series P7-40 and P7-50: Comparison of the chromate migration from 3 chromate pigments dispersed in methyl cellulose and measured after the ion migration through a lacquer film, 3.3 to 4.4 mil thickness.

Color differences after 112 hours immersion in distilled water.

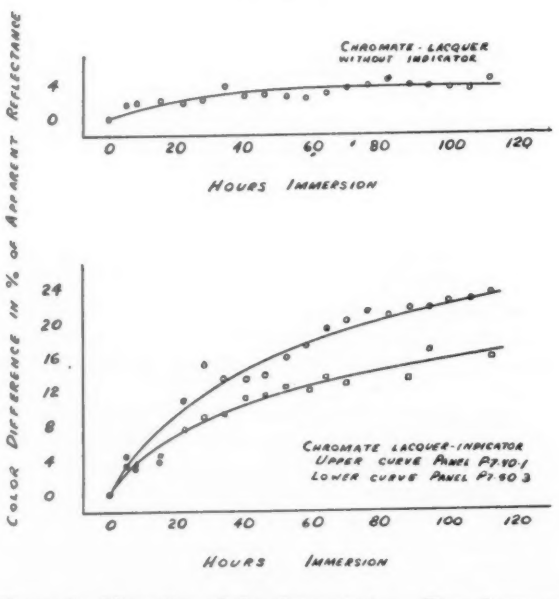


Figure 7. Migration of the chromate ion. Zinc chromate with methyl cellulose as vehicle.

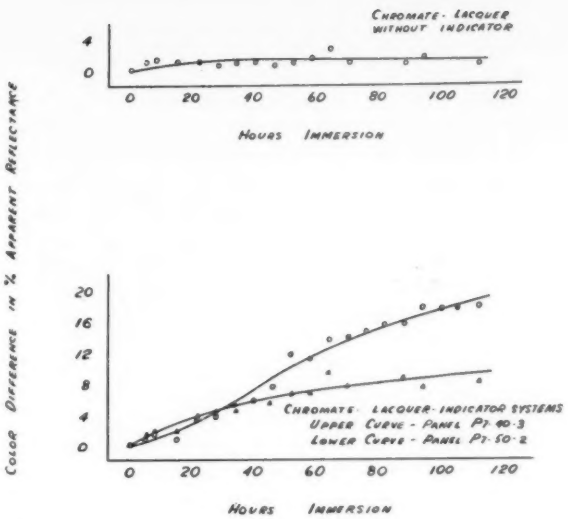

CHROMATE - LACQUER WITHOUT INDICATOR
COLOR DIFFERENCE IN % APPARENT REFLECTANCE
HOURS IMMERSION
CHROMATE - LACQUER - INDICATOR SYSTEMS
UPPER CURVE - PANEL P7-40-3
LOWER CURVE - PANEL P7-50-2

Figure 8. Migration of the chromate ion. Basic zinc chromcate with methyl cellulose as vehicle.

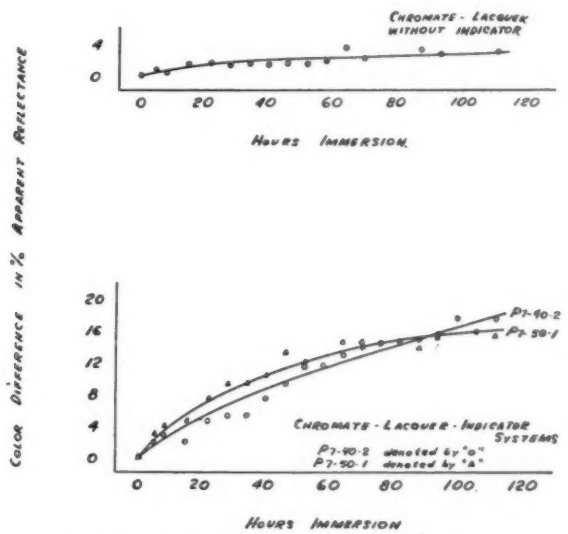


Figure 9. Migration of the chromate ion. Strontium chromate with methyl cellulose as vehicle.

In comparing the color difference results of the metal chromate pigments in methylcellulose of Table 12 with those of the dissolved potassium chromate in the methylcellulose film of Table 6, the following data are to be considered:

1. The immersion test data would be obtained for about twice the length of time.
2. While the soluble chromate panels (#3 and #4 of table 6) showed a color change of about 25, after 50 hrs. immersion, the zinc chromate of Spec. TT-Z-415, Type II showed a color difference of 12.4 and 16 after 52 hrs., the basic zinc chromate showed a difference of between 6.7 and 11.6, and the strontium chromate showed a difference between 11.3 and 11.9. After 112 hrs. immersion, none of the zinc chromate pigment panels reached the color difference values which the soluble chromate panels had reached after 50 hrs. immersion.

But the results also show that as long as the moisture penetrates through the organic top layer into the methylcellulose system, there is a migration of chromate ions from the zinc or strontium chromate pigment through the interlayer into the indicator layer to quite a considerable extent. It was, therefore, of interest to use the pigments in a different vehicle which is of low water permeability. As this vehicle, a phenolic oil varnish was selected.

Studying Phenolic Varnish Vehicle

In this study a vehicle was used which was a phenolic varnish prepared from a non-heat-reactive-oil-soluble, butyl-phenol resin with 15 gal. of dehydrated castor oil per 100 lbs. resin.

Pigments Used

1. A zinc chromate pigment of low content of soluble matter; that is, a zinc chromate low in Cl (not more than 0.10% Cl) and low in SO_3 (not more than 0.20% SO_3) as specified in the Federal Specification TT-Z-415, Type 1 (#2127).

2. A zinc chromate of somewhat higher content of soluble matter; that is, not more than 0.80% Cl and not more than 3% SO_3, as specified in Fed. Spec. TT-Z-415, Type II. (#883)

3. A basic zinc chromate or zinc tetra-oxy-chromate, containing 16.9% CrO_3 and 71% ZnO with 0.81% water soluble matter (#2259), such as specified as part of Spec. MIL-C-15328 A.

PANEL:	FILM THICKNESS (MILS) #1	#2	#3	#4
a) CELLULOSE ACETATE SHEET	3.2	3.2	3.3	3.2
b) METHYLCELLULOSE LAYER WITH MERCUROUS NITRATE	1.2	0.8	1.1	0.9
c) CLEAR LACQUER COAT	0.8	1.5	0.8	1.1
d) ZINC CHROMATE PRIMER (FORMULA #4 WITH DIFFERENT PIGMENTS)	0.6	0.6	0.7	0.8
e) PROTECTIVE TOP LACQUER COAT	1.5	1.2	2.0	2.4

NOTE: PANELS #1 AND #2: ZINC CHROMATE #2127 (IMPERIAL)

PANELS #3 AND #4: ZINC CHROMATE #883 (IMPERIAL)

THE BLANK OF THIS SERIES HAD TO BE WITHDRAWN BECAUSE THE PRIMER DESTROYED THE PLASTIC SHEET BASE.

THE EDGES OF ALL 4 PANELS WERE TAPED AND THE PANELS IMMERSED IN DISTILLED WATER.

Table 13. Study of the chromate migration from a chromate-phenolic primer: Series P7-22.

Composition of layer panels for the study of the chromate migration for two different zinc chromates having a different degree of water-solubility.

PANEL #	Av. of 2 pts.	0 Hr.	2.5 Av.	5 Av.	8 Av.	21 Av.	50 Av.	75 Av.	102 Av.	125 Av.	168 Av.	196 Av.
	x	54.5	53.5	53.3	53.3	51.8	52.0	51.7	51.3	51.3	51.5	50.3
1	y	48.5	47.7	47.2	47.0	46.2	46.0	45.7	45.2	45.3	45.7	44.2
	x	6.5	6.0	6.0	6.0	6.0	6.8	6.8	6.5	6.8	7.3	6.5
	x	54.2	52.5	53.5	53.0	52.2	51.5	52.0	51.7	51.7	51.7	50.8
2	y	47.8	47.8	47.2	47.5	46.8	46.0	46.2	45.8	45.3	45.8	44.7
	x	7.0	6.2	6.3	6.3	6.0	7.0	7.0	6.5	6.8	7.5	6.5
	x	57.5	56.5	56.5	56.5	56.0	55.7	55.3	54.3	54.8	54.8	53.8
3	y	52.2	51.0	50.8	50.8	50.2	49.8	49.5	49.0	49.0	49.3	48.3
	x	7.0	6.5	6.5	6.5	6.5	7.0	7.5	7.0	7.3	8.0	7.0
	x	55.2	54.8	54.3	54.3	52.0	51.5	51.8	50.2	54.0	55.2	55.7
4	y	50.3	49.0	48.8	48.8	47.5	45.8	46.5	45.0	48.5	51.2	50.2
	x	7.3	7.0	6.8	6.8	6.8	7.8	8.3	7.5	8.5	9.3	8.5

PANEL #	Av.	220 Av.	259 Av.	287 Av.	310 Av.	354 Av.	407 Av.	454 Av.	523 Av.	595 Av.	689 Av.	808 Av.
	x	49.7	50.2	50.0	48.8	49.8	48.3	49.3	48.8	50.2	49.8	50.3
1	y	44.0	44.3	43.7	43.3	44.2	43.3	43.7	43.2	44.0	44.7	44.8
	x	5.8	7.3	6.8	6.8	7.5	7.3	7.7	7.7	8.3	8.8	9.7
	x	50.7	51.0	50.7	51.0	50.8	50.7	50.0	50.7	51.3	50.8	51.3
2	y	45.0	45.2	44.8	44.5	45.3	44.7	44.3	44.5	45.2	45.5	45.6
	x	7.0	7.3	6.8	6.8	7.5	7.5	7.5	7.3	8.0	8.2	8.8
	x	54.0	54.2	53.7	53.3	53.5	53.8	53.0	53.2	53.7	53.8	54.5
3	y	48.0	48.7	47.8	48.5	48.7	48.7	48.2	47.7	48.2	48.7	49.5
	x	7.2	7.6	7.3	7.5	8.0	8.0	7.8	8.2	8.7	9.2	10.0
	x	56.8	56.8	55.8	56.8	56.8	57.7	57.7	58.8	58.7	58.7	59.3
4	y	51.0	51.0	50.5	50.7	52.0	52.8	52.0	56.0	54.2	53.8	54.7
	x	5.8	5.5	5.0	5.0	4.7	4.7	5.3	10.0	10.8	11.2	11.6

SERIES DISCONTINUED AFTER 808 HRS. ALL PANELS BLISTERED AND CRACKED.

Table 14. Series P7-22: Layer panels based on two zinc chromates of a different solubility in a phenolic vehicle (Using mercurous nitrate as indicator).

HRS. IMMERSION	VISUAL OBSERVATIONS
28 HRS.	Panel #4 had an air space between the indicator layer and the plastic layer.
119	Panel #4 had water trapped between indicator and plastic.
125	Panel #4 showed a break in coating at the very top of panel.
192	A break appeared in the upper right hand corner (front) of Panel #1.
198	Panel #4 showed a few reddish, brown spots.
407	Cracks appeared in the following panel areas: Panel #1: lower right corner. Panel #2: lower left corner. Panel #3: lower right corner, also across center.
454	All previously mentioned cracks appeared on the indicator layer by turning the indicator brown.
508	Series discontinued. Penetration through cracks. All panels blistered and cracked.

Table 15. Series P7-22: Study of zinc chromate as source of chromate migration. Visual observation during the immersion test.

HRS. OF IMMER-SION	ZINC CHROMATE #8127 (LESS SOLUBLE) PANEL: P7-22-1				PANEL: P7-22-2				ZINC CHROMATE #883 (MORE SOLUBLE) PANEL: P7-22-3				PANEL: P7-22-4			
	a	b	L	CD	a	b	L	CD	a	b	L	CD	a	b	L	CD
0	18.5	50.7	69.6	0	19.8	50.5	69.2	0	15.9	54.2	72.2	0	14.9	52.4	71.0	0
198	19.2	48.2	66.4	4.1	19.4	48.8	66.8	3.0	17.1	51.3	69.6	4.0	16.6	50.3	70.8	2.7
407	16.2	46.6	65.8	6.0	19.0	47.2	66.8	4.2	15.6	49.8	69.7	4.7	14.4	50.6	72.7	2.8
595	19.7	45.3	66.4	6.4	19.2	46.8	67.2	4.3	16.8	48.5	69.3	6.7	15.0	50.2	73.6	3.8
808	16.7	44.0	67.0	7.4	17.1	46.2	67.6	5.4	15.1	47.6	70.5	8.9	13.2	49.6	73.9	4.4

Table 16. The calculated CD values for the tests using zinc chromatepigments in phenolic varnish vehicle.

PIGMENTS USED: PANEL #1: BASIC ZINC CHROMATE (IMPERIAL X2259) ACC. TO MIL-C-15328A.

PANEL #2: ZINC CHROMATE (IMPERIAL X883) ACC. TO FED. SPEC. TT-Z 415, TYPE II.

PANEL #3: STRONTIUM CHROMATE (KENTUCKY X2396) (48-49% SrO, 45-46% CrO_3)

LACQUER USED: CLEAR ALKYD MODIFIED NITROCELLULOSE LACQUER, ACC. TO MIL-L-7178.

COMPOSITION OF EACH PAINT:
4 g. PIGMENT GROUND UP WITH
18 g. LACQUER.

BLANK: PANEL #4: A PLAIN, CLEAR, LACQUER FILM WAS USED INSTEAD OF THE PIGMENTED MATERIAL.

COMPOSITION OF THE TEST PANELS:

PANEL:	THICKNESS (MIL) #1	#2	#3	#4
a) CELLULOSE ACETATE SHEET.	3.7	3.7	3.9	3.7
b) METHYLCELLULOSE LAYERS WITH MERCUROUS NITRATE AS INDICATOR	0.5	1.2	0.9	1.2
c) CLEAR LACQUER COAT.	4.6	5.4	4.9	5.1
d) PIGMENTED LACQUER.	5.0	3.9	4.1	3.0
e) PROTECTIVE TOP LACQUER COAT.	1.2	3.1	3.0	1.2

Table 17. Study of the chromate migration from a chromate lacquer primer (Series P7-50).

VISUAL APPEARANCE DURING 396 HRS. WATER IMMERSION.

SERIES P7-56:

BEFORE IMMERSION: PANEL #1 HAD TWO CRACKS.

AFTER 19 HRS.: PANEL #1 HAD ONE CRACK.

AFTER 62 HRS.: PANEL #1 HAD THREE SMALL ADDITIONAL CRACKS.

AFTER 228 HRS.: PANEL #1: LACQUER LAYERS CRACKED AND PEELING FROM CELLULOSE ACETATE. WHITISH APPEARANCE IN UNDERNEATH LACQUER LAYERS.

PANELS #3 AND #4: WATER PENETRATION IN SPOTS.

AFTER 396 HRS.: ALL PANELS: WATER HAD LOOSENED LAYERS FROM THE CELLULOSE ACETATE BASE.

Table 18. Study of the chromate migration from a chromate lacquer primer.

In test series P7-22, panels #1 and #2 contained the zinc chromate #1 having the low soluble content, and panels #3 and #4 contained the zinc chromate #2 with the slightly higher content of soluble matter.

THE x, y, z READINGS DURING 396 HOURS WATER IMMERSION.

PANEL #		INSTRUMENT READINGS 0 Hrs.		Av.		19 Hrs.		Av.	43 (Av.)
	x	60.0	58.0	61.5	59.8	61.5	60.5	63.0	61.7	59.7
1	y	50.5	50.0	52.5	51.0	52.5	52.0	53.5	52.7	50.7
	z	5.0	4.5	4.0	4.5	7.5	7.0	6.5	7.0	8.0
	x	62.0	60.5	63.5	62.0	63.5	62.0	64.0	63.2	60.3
2	y	56.0	54.5	57.5	56.0	57.0	56.5	58.5	57.3	54.5
	z	6.5	7.0	7.0	6.8	10.0	10.0	9.5	9.8	9.8
	x	66.5	62.5	63.5	64.2	68.0	65.0	66.5	66.5	62.7
3	y	60.5	57.0	57.0	58.2	62.0	60.0	61.0	61.0	52.8
	z	11.5	11.5	11.5	11.5	14.0	14.0	14.0	14.0	14.2
	x	58.5	55.0	57.0	56.8	60.0	56.5	58.5	59.3	57.3
4	y	55.5	51.5	55.0	54.0	58.5	55.0	56.5	56.7	54.7
	z	38.5	35.0	36.5	36.7	40.0	35.0	37.5	37.5	33.8

PANEL #		READINGS CONTINUED (Av. of 3 readings) 62 Hrs.	109 Hrs.	228 Hrs.	396 Hrs.
	x	58.5	56.2	59.5	57.2
1	y	49.5	48.7	52.0	50.5
	z	6.3	9.2	16.5	16.2
	x	58.7	56.0	56.3	56.5
2	y	53.2	50.3	50.8	50.8
	z	9.0	10.8	15.5	16.5
	x	61.7	58.0	57.0	59.2
3	y	55.3	53.2	52.3	54.3
	z	13.0	14.5	17.2	20.2
	x	54.3	52.8	56.8	58.2
4	y	51.3	50.5	53.5	55.5
	z	32.7	31.0	34.2	37.0

Table 19. Study of chromate migration from a chromate lacquer primer (Series P7-56).

HRS.	BASIC ZINC CHROMATE #2259 a	b	L	CD	ZINC CHROMATE #883 a	b	L	CD	STRONTIUM CHROMATE #2396 a	b	L	CD	BLANK a	b	L	CD
0	16.4	55.9	71.4	0	17.4	57.1	74.8	0	16.7	52.0	76.2	0	7.2	17.7	73.5	0
19	26.2	53.3	72.5	2.8	16.7	52.8	75.7	3.5	14.8	50.7	78.1	3.0	6.5	19.2	78.2	2.3
43	28.5	50.3	71.1	5.6	16.7	51.7	73.8	5.5	13.5	48.1	76.0	5.1	6.7	21.6	73.9	4.0
62	27.1	52.0	70.3	4.1	16.1	51.8	73.0	5.7	18.0	47.5	74.4	5.0	7.9	19.7	71.7	2.8
109	22.5	47.4	69.7	9.5	17.0	46.9	71.1	10.8	13.7	44.2	73.0	9.0	6.2	21.0	71.0	4.3
228	21.0	39.9	72.1	16.9	15.8	40.6	71.2	17.0	13.3	39.8	72.3	13.2	8.5	6.3	73.2	11.5
396	19.1	39.1	71.1	18.3	16.3	39.2	71.3	18.2	12.5	37.5	73.7	15.0	6.8	18.7	74.5	1.5

NOTE: THE DECREASE IN THE COLOR DIFFERENCE VALUE FOR THE PANEL IN THE LAST PERIOD IS BELIEVED TO BE CAUSED BY CRACKS OCCURRING IN THIS PANEL.

COMPARISON OF THE CD VALUES FOR THE ZINC CHROMATE # 883 IN THREE DIFFERENT VEHICLES

HOURS OF IMMERSION	CD VALUES IN METHYLCELLULOSE (From Table 14)	IN NITROCELLULOSE LACQUER (From Table 20)	IN PHENOLIC VARNISH (From Table 16)
0	0	0	0
45	11.7	5.5	-
110	15.9	10.8	-
200	-	17.0	4.0
400	-	18.2	4.7
454	-	-	6.7
808	-	-	6.9

Table 20. The color changes calculated for chromate-pigmente d lacquer systems (Series P7-56).

These primer paints were made using:

Chromate pigment	399 parts
Zinc Oxide	57 parts
Fibrous magnesium silicate	114 parts
Phenolic resin varnish	356 parts
Lead naphthenate (24%)	3.32 parts
Cobalt naphthenate (6%)	1.78 parts
Xylol	71 parts
Toluol	142.5 parts

The preparation of the test panels is shown in Table 13. Mercurous nitrate as an indicator was used.

The readings on the immersed panels are shown in Table 14. The visual observations are shown in Table 15. The color change values are given in Table 16.

The results clearly indicate that:—

1. In a phenolic system, there is very little free chromate ion movement to the substratum under

water immersion. This is caused by the much smaller amount of moisture which penetrates the primer.

2. Because of the small amount of chromate migration, there is very little difference between the results obtained by the use of two different zinc chromates which were—in accordance of the specification—of a different degree of water-solubility.

The attempt was made to increase the severity of the test by immersing the panels in saltwater instead of distilled water. The tests were made using the same two zinc chromates and a strontium chromate. However, a difficulty was observed in that the tests had to be continued for a long time before color changes were observed. Also, then a failing of the cellulose acetate base layer was observed which allowed the saltwater to make contact with the underlayer from below, thereby permitting the metal ions of the indicator material to escape into the saltwater. (The indicator material was cupric nitrate in this case). For this reason the 1000 hr. salt-water test was considered invalid.

It also became of interest to study how much this type of chromate migration to the substratum would increase when a different organic material, which was more water permeable, was used as the vehicle for the chromates.

As the more permeable vehicle the same alkyd modified nitrocellulose lacquer was used (MIL-L7178) which had previously served as the sealer on top of the chromate vehicle layer and as the sealer between the chromate and the indicator layers. The results are given in Part D.

Studying Nitrocellulose Vehicle

The fact that the lacquer vehicle used in this test group was of a suitable permeability to moisture and to chromate ions has been established earlier in this investigation. It was, therefore, of interest to establish how its characteristics would affect the chromate migration of different chromates.

The pigments which were used and the composition of the test paints are shown in Table 17 together with the description of the test panels.

The visual appearance of the panels is given in Table 18.

The experimental readings are given in Table 19.

The resulting color differences are shown in Table 20.

In comparing color changes in the pigments dispersed in the alkyd modified nitrocellulose lacquer with the color changes observed in the phenolic vehicle of Table 16, the following facts are evident:

1. All the chromate pigments tested show, with the higher water permeable vehicle, a considerably higher degree of free chromate migration to the substratum. In the comparative time interval at around 400 hours, the chromate measured with the lacquer vehicle amounts to three to four times that measured in the various tests with a phenolic vehicle as shown in Figure 10.

2. The phenolic varnish paints showed after 800 hours immersion one-half to one-third of the chromate migration which was measured on the chromate pigments in the lacquer vehicle. What

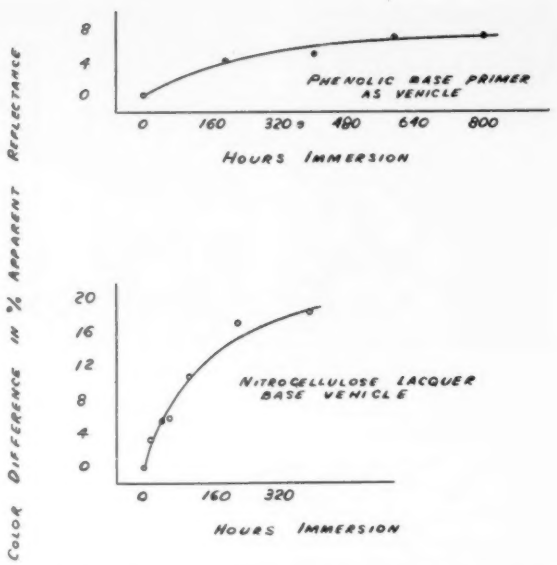


Figure 10. Effect of vehicle on chromate ion migration (zinc chromate).

effect this higher degree of chromate migration to the substratum might have on the preservation of the substratum itself, will be studied further for presentation in a subsequent paper.

Summary

A method has been established for the study of the influence of moisture penetration through a protective coating system on the chromate matter contained as pigmentation of the system.

The base material for the test system was a transparent plastic film (cellulose acetate) on which an organic coating, containing a material which changes color in contact with chromate ions, was placed. This substratum was sealed off by a clear, nitrocellulose lacquer film upon which a second organic coating was applied containing the source of chromate ions. This again was sealed off by a nitrocellulose lacquer.

Moisture penetration through the lacquer sealer was introduced by water immersion of the layer panel. The color changes were measured at given time intervals.

It has been established that the amount of chromate ion migration depends on two factors:

a) The amount of available chromate, either as a soluble chromate or as part of a chromate pigment such as zinc or strontium chromate.

b) The water resistance of the organic vehicle used.

In the case of a phenolic resin-oil varnish vehicle, the amount of chromate which reached the substratum was very small, regardless of the kind of test chromate employed.

When a methyl cellulose solution was used as the vehicle, considerable chromate migration through the nitrocellulose lacquer film was observed. When the same lacquer was used also as the dispersing medium of the chromate pigment, the chromate migration observed was of an order between that noted when the phenolic resin varnish was used and that when the methylcellulose solution was used as dispersing medium.

Manufacturers' Forums and Panel Discussions Highlight

69th NPVLA CONVENTION

SOME 1,200 members and guests of the National Paint, Varnish and Lacquer Association gathered in Los Angeles during November 12, 13, and 14th on the occasion of their 69th Annual Convention.

In addition to the general session, four interesting forums dealing with advertising and sales promotion, roof coatings, putty, glazing and caulking compounds, and trade sales were held. Another highlight of this meeting was a panel discussion on "What Is Expected of Our Products" conducted by the Industrial Product Finishes Technical Committee.

Pres. J. F. Battley

In his annual address entitled, "There is No Other Way to Look Except Ahead," President Battley said—

"New peaks in other industries sales were reached during 1956. But, while our total sales for the first nine months were $1,221,355,000 a gain of one percent over the similar period in 1955, and the establishment of another dollar sales record, of most importance, is the fact that our production volume has decreased. That is the danger sign to me."

President Battley then went on to point out that in 1947, the sale of paints and allied products represented 0.5% of the gross national product and that in 1955 sales have dropped to 0.4% which shows the extent of the potential market that the paint industry lost. He emphasized that now was the time to stop pitting paints against paints and start to compete against those products replacing paints in homes and other products.

JOSEPH F. BATTLEY
President

Leo Cherne

In describing his harrowing trip into Hungary and his race to the Austrian boarder, after having accomplished his mission, Mr. Cherne presented a most vivid account of what has taken place in Hungary during these recent weeks. He said—

"I have had many tragic opportunities in recent years—some of them I have conveyed to you—to see the blight of those who do not enjoy freedom, to see the price that is paid by some one who would enjoy freedom, but I have never in my life seen anything the equal of the sights, sounds, and smells which pressed in on my consciousness in the wild ride to Budapest and during some 36 hours in that beleaguered capital, 150 miles behind the Iron Curtain, and then the desperate drive out of Budapest in an effort to escape the Red Troops.

"I was there for a specific purpose, I left with a deep feeling of sorrow and satisfaction, sorrow at what I had seen, satisfaction in that the purpose had been accomplished or at least begun."

One of the features of the general session was a film presentation, "This Is Color." This was a non-technical film on the relation of light to color, demonstrated by animation. It was followed by a talk, "Color Is Style" by E. L. McCluskey, Board of Governors, National Chapter, American Institute of Decorators.

Product Finishes

The Industrial Product Finishes Luncheon and panel discussion for management personnel attracted an overflowing audience. This was understandable, since the topic of discussion was "What is Expected of Our Products" and the panel included experts in automotive finishes, furniture finishes, appliance finishes, and metal finishes. Presiding was Dr. Gustave Klinkenstein, chairman of the Industrial Product Finishes Technical Committee.

Covering finishes from the automotive industry's point of view,

G. M. HILL

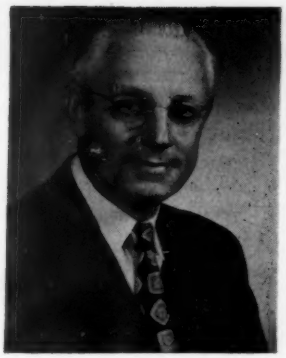
"Stains tend to change color with age. More work is needed to improve color stability."

H. W. SACKS

"End use of product must be given full consideration when testing the organic finish."

E. L. FANEUF

"Plastics of all type have been used on almost every appliance made."



R. J. WIRSHING

"The advent of the new acrylic type lacquers is a big step in improving luster retention."

R. J. Wirshing of the General Motors Company pointed out that it was difficult to reliably predict performance in service by means of accelerated laboratory test. Thus General Motors decided to go out into the highways and examine what was happening to the finish on automobiles. He said that the final test is run by customers of General Motors, who allow their cars to stand on the streets and in parking lots where G.M. technologists are free to go and evaluate the results.

Describing the inspection in detail, Mr. Wirshing said—

"Annually a group composed of men in charge of painting in our various divisions are joined by technical representatives from our principal paint suppliers and companies that supply metal treating chemicals. With such a group we felt that we would have the advantage of years of experience in the formulation and application of paints for automobiles. Then too, if things were wrong, the men immediately responsible would be aware of the problem and could take steps to correct the trouble.

"We operate in teams of three, changing partners frequently. We record make, year, color and significant failures on IBM cards. We examine, one, two and three year old cars in Miami, Washington, D. C. and Detroit and usually one other city. In the past we have visited Dallas, New Orleans, Minneapolis and Seattle. Each year we have examined between seven and eight thousand cars, our own and competitors.

"The results of these surveys are what I would like to talk about today, pointing out the weak points of our finishing systems with the hope of gaining your help in improving them."

In discussing paint failures, Mr. Wirshing pointed out that there were two types. The first is failure of the film itself due to weathering, and the second is corrosion of the metal brought about by rupture of the film.

Failure of the film include chalking, cracking or checking, blistering and chipping. Both types of failure were fully described and methods adopted by automobile manufacturers to cope with these failures were also presented.

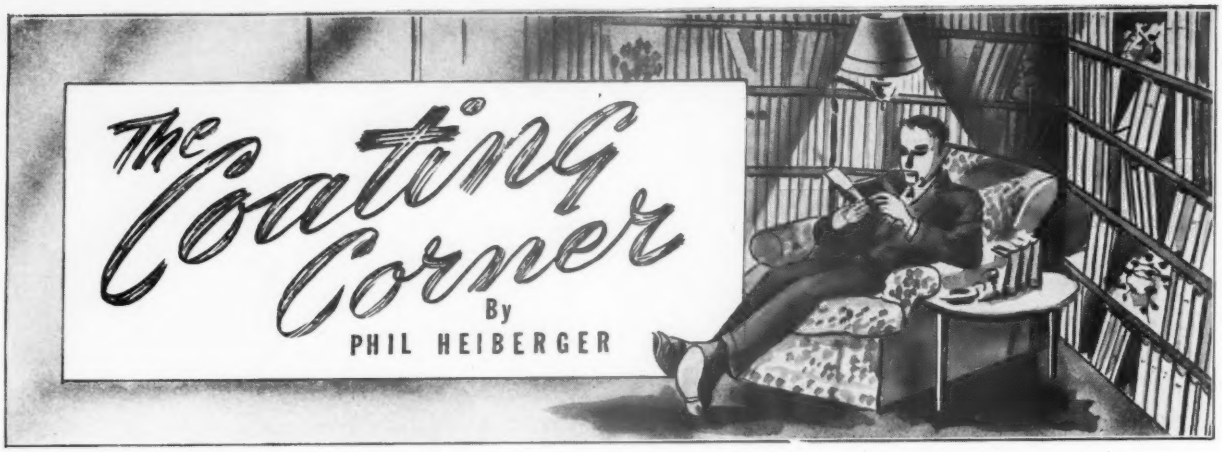
G. Maurice Hill, vice president of the Drexel Furniture Company outlined the problems that the furniture industry is facing in the way of finishes. He said—

"Problems involved in furniture finishing, and in fact, all wood finishing, are distinctly different from the problems of finishes on automobiles, appliances, and other metal products. In the simplest form and concept, finish on metal is a pigmented finish of some type, whether it be done with lacquer materials, with varnish materials, or with synthetic materials. The object here is to cover the basic material completely, and to create a color on top of the surface."

In summary, Mr. Hill outlined the following areas where improvements are needed.

1. *Color:* Stains, as well as other color applications tend to change color with age. More research is needed to improve color stability of these materials.
2. *Sealers:* Presently used sealers act as good fast drying sanding coaters, but have little true sealing value. They are penetrated, softened and reswelled by lacquer topcoats, and therefore, add little to filling and leveling. Good intercoat adhesion, toughness, and check resistance are also very essential and need to be improved.
3. *Filler:* There has long been the need for a filler less sensitive to solvent attack—to prevent or reduce swelling and reshrink, and subdue pinholing on very porous woods. There is a need for better adhesive qualities in fillers.
4. *Glaze:* There is a great need for glazes that will give better intercoat adhesion, but without loss of other exacting performance requirements.
5. *Lacquers:* An important objective is to improve long range adhesion, elasticity, check-resistance and better resistance against such things as alcohol and water.
6. *Synthetics:* Synthetics, although they have some qualities better than lacquer, continue to lack one important quality—little resistance to water. Synthetics do not have the

(*Turn to page 85*)



The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

Toxicity of Resins

TO those interested in the toxicology of synthetic resins, an article by *Rex H. Wilson*, M.D. and *William E. McCormick* in the November 1955 issue of *Industrial Medicine and Surgery*, pages 491 to 496, may offer some enlightening moments.

In this article entitled "*Plastics —The Toxicology of Synthetic Resins*," information from 78 published reports on the more important materials used in plastic manufacture is summarized.

It is indeed fortunate that the finished plastics (and paint films, of course) are relatively inert physiologically and non-toxic on contact, although the monomers, antioxidants, stabilizers, plasticizers, and other materials used therein may constitute a hazard.

For example, acrylic resins and finished products containing alkyds are considered physiologically inert. Reports on the toxicity of amino resins cover a wide range of effects. While they are dangerous if ingested, they are harmless in the cured state.

Cellulosics, coumarone-indenes, epoxies, fluorocarbons, nylons, polyethylene, silicones, polystyrenes, and vinyls are mentioned and all are classified as relatively inert non-toxic resins.

Phenolic resins are frequently associated with industrial dermatitis, however, finished laminates are apparently inert.

Phil Heiberger

Polymers In Vivo

AS the years roll by, I regret more and more my lack of formal biochemical training. To my mind at least, it seems that paint chemists and biochemists have many problems of mutual interest.

For example take the problem of aging, human aging. *John Bjorksten* pointed out that one of the likely mechanisms of aging is immobilization of tissue protein as would occur as the result of irreversible cross linkages. (*Science 124, 754, October 19, 1956*).

The unique effect of glycerine as a diffusion controller is not confined to industrial reactions. In blood, the rate of clotting can be markedly altered by increasing the glycerine content.

Now nutritionist *Norman Jolliffe* and medical researcher *Brian Bronte-Stewart* feel that saturated fats help raise cholesterol levels while unsaturated fats help lower them. This led to the suggestion that animal fats in diets aggravate circulatory disorders thus leading to heart damage. (*Time, Nov. 12, 1956, page 59*).

In a similar vein, *Dr. M. Szwarc* of the *New York State College of Forestry* delivered a paper to the American Chemical Society in Atlantic City in which he likened polymerization to biological growth. He compared initiation to birth, propagation to growth, termination to death, biological poisoning to polymerization poisoning, and so on.

Somehow I can't get over the feeling that if students of each discipline were more aware of the problems and techniques of related disciplines, the progress of each would be furthered.

A Tall Tale From Texas

WITH Edna Ferber's Texas "Giant" in prominent display these days, you might be in just the right mood for another tall tale from Texas. But this one is slightly different for several reasons. First, it is truer in specific detail; second, it has a moral; and third, it strated a train of thought. I picked it up, incidentally in my alumni magazine (University of Texas "Alcalde").

Apparently, employees of a certain nursery in Texas were given aptitude tests by the *Johnson O'Connor Human Engineering Institute* about two years ago. The general manager (ex-UT all-conference football guard Danny Wolfe) took the tests along with the others mainly in the spirit of being one of the boys.

To his great surprise, this musically ignorant Texan, who didn't even know the words of "The Eyes of Texas," was advised by the psychologists that he should be a musician. "At least," they counselled, "take up music as a hobby. It will keep you from becoming frustrated."

Danny took a mail order course and began playing the piano. Next thing he knew, he was writing tunes. And in almost less time than you could say "But what has this got to do with paint?" (I'll tell you in a minute), he was a successful selling songwriter with several western, popular, religious, children's, and blues songs to his credit.

The moral: Don't pooh-pooh psychological tests. While results, admittedly, are rarely as dramatic as in this story, the hard cold fact is that psychological tests can and do give valuable information about an individual's ability and potentiality—information that, in a time of technical shortage, is especially precious.

There's no question that we in the paint field can and should use to advantage the guidance offered by psychological tests in the selection and placement of technical personnel. We should make every effort to ferret out those with exceptional potentialities rather than rely solely on the time-worn methods of personnel evaluation based on training and experience.

Stig Akerfeldt of the Nobel Institute, by the way, has come up with a possible chemical test for mental illness. He found that N, N'-dimethyl-p-phenylene diamine added to the blood serum of mental patients changes its color from straw to various shades of red—"currant red" for schizophrenics. This test, if it is one, may even be quantitative—the deeper the color, the more serious the illness.

Can't you just visualize the day when this simple idea will be carried out to its not-illogical extreme?

Why, instead of going through the arduous and lengthy procedure of submitting to batteries of psychological tests (as we now know them) and subjective personal interviews when you're looking for a job, all you'll do is leave a drop of blood at the employment office for analysis, and in a jiffy, you'll hear the cheerful words "You're Hired!"

Jumping the gun, am I? Maybe so. I must try to remember what Tennyson said, "Science moves, but slowly, slowly, creeping on from point to point," and try to be patient.

A New Cloak For An Old Standby

THE older one gets and the longer one dwells in this fascinating and improbable world of chemistry, the more one is awed by the remarkable, often inexplicible effects achieved by the simple addition of minute amounts of chemicals to bulk products.

Today in the paint field, we depend upon and routinely and successfully use a host of additives with almost complete abandon and supreme confidence—whose whys and wherefore frequently elude us. I seriously doubt that there's one paint product sold today whose formula does not include at least one agent for controlling flooding, sagging, skinning, foaming, wetting, drying, or what have you. Many formulae include several.

Despite their indisputable contribution to paint quality, however there is often a feeling of shyness toward these tiny helpers. They are tolerated because we can't get along without them—but tolerated begrudgingly.

Perhaps the explanation is that we tend to shy away from the use of things we don't understand.

Vehicle, resin, and plastic manufacturers, I submit, use catalysts, chain breakers, inhibitors, pH buffers, co-solvents, etc. without apology. On the basis of quantities used, these also could be called additives and in fact were so called in days gone by.

This is a plea for more respect for additives regardless of nomenclature.

Glycerine, for example, now appears on the scene as the newest member of the additive family. It is a modifier for controlling vinyl polymerizations. Glycerine can increase the rate of reaction and the molecular weight of the resulting polymer.

According to recent news releases, this effect was discovered by *Dr. Gerald Oster*, associate professor of polymer chemistry, at the *Polytechnic Institute of Brooklyn*. Dr. Oster can explain the functioning of glycerine, and calls it an agent for modifying "diffusion-controlled chemical reactions."

Reactions where the rate is determined by the speed of diffusion of one reactant toward another are designated diffusion-controlled. Apparently glycerine increases the local viscosity of the reaction solution and this in turn influences the velocity of reaction. Local viscosity is the viscosity of the medium immediately surrounding the molecules in solution.

Other thickening agents such as gelatin or polyvinyl alcohol increase the viscosity of the entire solution, i.e., macroscopic viscosity, and have no effect on the reaction rate.

In the case of vinyl polymerizations, the increase in local viscosity caused by glycerine decreases the rate of the termination steps in the polymerization and therefore permits the polymerization to continue longer. The result is the formation of high molecular weight polymers.

Arsenic Again

WITH arsenic so much in the news recently, it may be instructive to note that arsenic compounds have evidently not been completely ruled out of the paint picture as yet (at least not in the research laboratory).

M. Kuhn, in an article entitled "*Modern Rust-Protective Paints, Theoretical Bases and Practical Observations*" (*Farbe u. Lack 61, 552, (1955)*), suggests that arsenic derivatives be used as replacements for the phosphorus containing acids. Alkyds containing arsenic and phosphoric acid radicals are reputed to have excellent protective value.

What a pity! To have on hand a possible answer to better finishes and not be able to use it.

NEWS

ASTM Studies Radiation Effects On Plastics

The American Society for Testing Materials has formed a subcommittee to study the effects of nuclear and high energy radiation on the properties of plastics and electrical insulation. Chairman of the new subcommittee is D. S. Ballantine of Brookhaven National Laboratory.

At the first meeting of the group in St. Louis, on October 16, the chairman emphasized the great need for standardization in the field of radiation effects and the timeliness of ASTM's decision to form such a committee at this time. He said the data already existing in the field of radiation effects on materials are in many cases confusing, and instances of outright contradictions are not uncommon. This condition prevails in part, Mr. Ballantine explained, because: (1) different sources of radiation are employed; (2) different methods are used to determine and express the radiation doses which have been received; (3) the irradiations are done under differing conditions of atmosphere, temperature, and time; and (4) because different test methods are used to evaluate the results.

The subcommittee on radiation effects is sponsored jointly by ASTM Committee D-20 on Plastics, F. W. Reinhart, chairman, and D-9 on Electrical Insulating Materials, H. K. Graves, chairman. So far it has established sections to work in the areas of nomenclature and definitions, dosimetry, correlation of various sources of radiation, total dosage and dose-rate effects, and post irradiation effects.

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Freeman Appoints Agent

The Freeman Chemical Corp., Port Washington, Wisc., manufacturer of vehicles for the coating industry, has appointed Charles M. Rice & Co., Cleveland, Ohio, as its representative in the Cleveland area.

Nuclear Research Center Completed

Completion, at Battelle Memorial Institute, Columbus, Ohio, of the nation's first, privately owned Nuclear Research Center has been announced by Dr. Clyde Williams, president and director of Battelle. The announcement follows initial "start-up" of the Institute's one-million-watt research reactor.

The ¾ million dollar reactor is the largest of the "pool type" yet to be put into service in this country. It is designed exclusively for research purposes.

This picture shows the full, three-story height of the cast concrete pool in which Battelle Institute's research reactor operates.

Dr. Williams points out that just over a year ago radiation laboratories were completed for Battelle. Then, in February of this year, Battelle announced completion of a laboratory for reactor development. Now the reactor becomes the third major new unit added to the Battelle Nuclear Research Center in the past 13 months.

The newly completed reactor, according to Dr. H. R. Nelson, who directed development of the new Research Center, uses solid uranium-235 fuel. The core, composed of fuel elements and boron control rods, is suspended 22 feet below the surface in a large pool of highly purified water. The water serves as the coolant and as a shield to protect personnel from the radiations.

Battelle's Nuclear Research Center, states Dr. Nelson, was built in anticipation of the large expansion of nuclear research as a result of the Atomic Energy Act of 1954, which permits private industry to enter upon commercial development of the atom. The Center makes available to industry complete facilities for peacetime nuclear energy studies.

The new reactor will be used in research on the chemistry of petroleum, sterilization of pharmaceutical products, preservation of agricultural goods, and improvement and development of numerous chemical, glass, plastic, ceramic, and metallic products and processes.

Paint Sales Set Record

Figures recently released by the Bureau of the Census, U.S. Department of Commerce for September, 1956 report total industry sales in paint, varnish and lacquer products at $128,411,000. This brings the nine-month total to $1,221,355,000, an increase of one per cent over the previous nine-month record established in 1955.

The September figure of $128.4 million is the second highest September on record, exceeded only by September, 1955. Of this total, Trade Sales were $79,481,000. The nine-month total for this category is $736,092,000, an increase of 2.1 per cent over the same period in 1955.

Industrial Sales totaled $48,930,000 for September while the nine-month total reached $485,263,000. This latter total represents a decrease of .6 per cent from the record nine-month total set last year.

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Dow Opens New Plant

A new plant for the commercial production of styrene-butadiene latexes is now in operation at the Western Division of the Dow Chemical Co. in Pittsburg, Calif.

The California plant is the fourth Dow latex supply point, the product also being manufactured at Midland, Mich., Velasco, Tex., and Sarnia, Ont., Canada.

According to R. L. Curtis, vice president and general manager of the company's Western Division, cost of the new plant was in excess of one million dollars.

NEWS

West Coast Gets Its First Ethylene Chemical Plant

The Pacific Coast's first petrochemicals plant producing ethylene oxide, ethylene glycol, and polyethylene is now in operation in Torrance, Calif., according to an announcement by D. B. Benedict, president of Carbide and Carbon Chemicals Co., a division of Union Carbide and Carbon Corp.

The Torrance plant, located on a 140-acre site, consists of highly specialized equipment said to be unlike anything in the area. Conversion of petroleum gas into chemicals is carried on in tanks, towers, and miles of pipe. Much of the gas is brought in from the neighboring General Petroleum Co.

Production processes at the Torrance plant are largely controlled by automation and continue on stream 24 hours a day. There are 350 employees, all hired locally except for a small management staff. Safety for employees is assured by the most modern safety and fire protection devices and by intensive safety training programs.

Of special interest to people in the California area, Mr. Benedict believes, is the company's "positive approach" to the problem of air pollution. He says that from the time plans for the Torrance plant were drawn, Carbide and Carbon Chemicals Co. has followed recommendations made by the Los Angeles Air Pollution Control District in regard to installing devices to dispose of unused gases without polluting the air.

Construction of the plant at Torrance began in June, 1953 as part of a major Carbide expansion program which has included the building of similar petrochemicals facilities at Seadrift and Texas City, Tex. Petrochemicals are chemicals using petroleum gases as their raw materials. The petrochemicals industry is said to stem from the original work of Carbide's research leader, Dr. George O. Curme, Jr., in 1914.

Today's petrochemicals reportedly represent over half the value of all chemicals produced. Among derivatives from just the ethylene fraction of petroleum are products for use in plastic making, and the manufacture of lubricating oils, synthetic fibers, detergents, cosmetics, textile specialties and all-winter anti-freezes.

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Plant Maintenance Show To Be Held Next Month

Sixty-two speakers will head discussions at the 8th Plant Maintenance & Engineering Conference in Cleveland's Public Auditorium next month. The conference is being held in conjunction with the Plant Maintenance & Engineering Show which runs from January 28 through January 31.

The show, expected to be the largest in its history, will attract executives from most of the country's largest industrial firms. Altogether an audience of more than 20,000 is anticipated for the show and some 2,500 engineers for the conference.

Maintenance procedures for every type of industry will be described in the sessions, and thousands of products will be demonstrated by 400 exhibiting companies. Many industries will be given extra attention by the assignment of special conference sessions. These industries include metal working, chemical, petroleum, textiles, paper production, and rubber production.

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Reichhold Expands

Two new formaldehyde plants, added to existing facilities of Reichhold Chemicals, Inc. at Detroit, Mich., and Tuscaloosa, Ala., each will increase production by 35 million pounds a year, Henry H. Reichhold, company president, has announced.

At Tuscaloosa, also, pentaerithritol volume will be stepped up from four million to 10 million pounds annually, while yearly phenol production is raised from 50 million to 75 million pounds.

CAMPUS TO INDUSTRY: On October 15th, Resin Research Laboratories of Newark, N. J., acted as host to the advanced class of Rutgers University entitled "Laboratory Techniques and Latest Developments in Coating Technology." Staff members of the laboratories demonstrated the latest developments in instrumentation for research and production to the students, after which modern methods used in the evaluation of organic coatings were discussed.

NEWS

Low-Cost U. S. Castor Oil Production Is Foreseen

Low-cost castor oil, a firm domestic supply and a non-fluctuating market were possibilities seen in the West as a result of the encouraging performance of newly-designed mechanical harvesters. Also contributing to the bright picture is the development of new hybrid varieties with higher yield.

Until very recently the harvesting of castor beans in this country has been done by hand. Use of castor oil in the United States was only 60,000 tons in 1955, chiefly in sebacic acid and surface coatings. Of this total, 95 per cent was imported.

Now, research by the U. S. Department of Agriculture and industry has resulted in construction of several harvesters which can move through a field of castor plants to garner the valuable bean. This development was possible after the castor plant had been modified by making it less readily dehiscent.

Further experimentation, again showing the USDA in a prominent role, has also produced a hybrid castor bean which is higher yielding and more suitable for mechanical harvesting. Varieties of this bean now yield 3,000 pounds per acre in commercial production and over 5,000 pounds per acre on large experimental lots.

The higher yields and more economical mechanical harvesting of the beans open the way for a substantial domestic production of castor oil based on home grown beans. Such production would serve to stabilize the supply and price of the castor oil, to the advantage of many industries.

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Yenkin-Majestic Appoints

Yenkin-Majestic Paint Corp., Columbus, Ohio, has appointed S. S. Skelton Co., Cleveland, as sales representative for its alkyd resins, in the Cleveland and Toledo, Ohio area and in Detroit, Mich.

Ohio Council Discusses Latex and Epon Coatings

Latest developments in emulsion paints and Epon chemical resistant coatings were reviewed by a panel of experts for 125 members of the Ohio Council, Painting and Decorating Contractors of America at their 65th Annual Convention October 26, in Canton, Ohio. William Jenuelson of the Arco Co. acted as moderator for the panel which consisted of W. B. Mozo, Shell Chemical Co., Richard Parker, Dow Chemical Co., Harold Jaffe, Colton Chemical Co. and Gerould Allyn, Rohm & Haas Co.

William Jenuelson, Research Department of the Arco Co., introduces panel members to annual convention of Ohio Council, Painting and Decorating Contractors of America. Those shown (left to right) are: W. B. Mozo, Shell Chemical Co.; Richard Parker, Dow Chemical Co.; Mr. Jenuelson; Charles Berning, President, Ohio Council PDCA; Harold Jaffe, Colton Chemical Co.; and Gerould Allyn, Rohm and Haas Co.

Epon resin paints for use in the maintenance work of chemical plants and other industrial locations where heavy fume conditions exist were discussed by Mr. Mozo. Mr. Mozo said that such paints were attracting widespread interest among painting contractors. He also noted that use is being found for the Epon Coatings as heavy duty coatings for concrete floors in laboratories and hospitals where chemicals might be spilled on floors.

A film, "The Magic of Color," prepared by Dow Chemical Co. was shown by Richard Parker. He pointed out from it that butadiene styrene latex paints were helping the painting contractor increase business and interest more customers, since latex paints are cheaper to apply than oil based paints.

Harold Jaffe said of polyvinyl acetate paints that although they were first developed in Germany and were introduced in California five or six years ago, their use in the Ohio area is just now starting. Mr. Jaffe cited advantages of polyvinyl acetate paints, including improved storage stability, low angular sheen, quick drying, and reduced odor. He pointed out, too, that all three types of latex paints, butadiene styrene, polyvinyl acetate and acrylic, breathe moisture vapor and thus are very resistant to blistering under humid conditions.

Acrylic paints were discussed by Gerould Allyn, who said they are the newest of the latex paints to be offered to the painting contractor. He considered them to hold many advantages for the professional painter for use indoors on plaster and wallboard; and outdoors on stucco, cement, cinder block, and asbestos shingles. He said, for example, that acrylic paints can be recoated with either latex or oil based paints in from 15 to 30 minutes. In addition, they can be used over fresh plaster or stucco without danger of alkali burn, and they are extremely durable in outside exposures.

ADM Offices Merge

Consolidation of Archer-Daniels-Midland Company's offices in Kansas City, Mo., was announced last month. William Bingham, formerly with the traffic department of the alfalfa division, is manager.

Activities which have been brought together include the flour and feed, alfalfa, resins and plastics, and chemical products divisions in the Kansas City area. ADM's grain division office in the Kansas City Board of Trade Building is not involved in the consolidation.

NEWS

Use of Silicones in Paint Discussed at ASTM Meeting

In order to acquaint those on the West Coast with some of the many investigative studies on paint, varnish, lacquer, and related products being carried on in Committee D-1 of the American Society for Testing Materials, a series of papers was presented at the group's West Coast meeting in September. This review covered in detail the many projects now under study: Drying Oils, Carbon Arc Light and Water Exposure Tests, Solvents and Thinners, Gloss Measurement—Past, Present, and Future, Methods for Preparation for Painting of Light Metal Alloy Surfaces, Progress in Measuring Color Difference, Latex and Emulsion Paints, and Varnish Testing.

Two sessions were devoted to a symposium comprising a number of papers in the paint field sponsored by the California Technical Program Committee. The extensive discussion at these sessions evidenced the wide interest in the project, providing the large number of paint companies in the Los Angeles area and the many large users of protective coatings an opportunity to review and discuss the newer types of paints and procedures for their testing and evaluation.

Of particular interest was H. L. Cahn's paper from General Electric on the use of silicones in protective coatings. Developed about 10 years ago, silicones were first used as the vehicle for high-temperature-resistant paints. Since that limited beginning, silicone use in the paint field has mushroomed and now includes: (1) organic vehicle modifiers, (2) silicone copolymer vehicles, (3) electrical insulation coatings, (4) additives for correction of film defects, (5) additives for better processing and structural masonry water repellents. There was considerable discussion of the use of silicones by state highway departments, building contractors, aircraft manufacturers, and finishers for calculating machines.

The extensive use of vinyl metal finishes was also reviewed by C. I. Spessard, Union Carbide and Carbon Co., and particularly methods for their testing. Since their inception in 1930, production of vinyl coatings has now increased to 650 million pounds in 1955, of which 27 million pounds were used for coatings. Their use has run the gamut from corrosion-resistant systems to highly specialized decorative finishes.

Surface treatments of metal prior to painting which are now widely used and so important in the organic coatings industry, came in for attention by A. J. Tuckerman, Bradley Paint Co.

Allied to the Symposium on Railroad Materials, in another section of the West Coast meeting, was an excellent review by G. J. Grieve, Pacific Paint and Varnish Co., of protective coatings in the railroad industry. That industry is known to suffer tremendous yearly loss from corrosion, and so proper preparation of each surface was stressed.

Other subjects covered were (1) evaluation of paints and protective coatings for municipal use, (2) methods for evaluation of protective coatings on metal surfaces in marine environments, and (3) control of phosphatizing systems.

The symposium was concluded by a paper on "Why Paint Specifications—Their Tests and Controls" in which it was stated that paint specifications are very useful to paint users. They should be so complete as to leave no area of conflict or argument. Paint specifications require test methods and procedures as essential components and these methods must be highly reproducible and tried.

G.E. Sells Eastern Rights In "Glyptal" Alkyd Resins

Arrangements were undertaken recently for the sale of General Electric Company's eastern interests in alkyd resins to the Archer-Daniels-Midland Co. of Minneapolis, Minn. According to General Electric, this decision to negotiate was made after weighing the cost and time factors involved in reconstituting alkyd resin facilities equivalent to those destroyed by the Schenectady fire last March.

The new plan will call for a transfer of inventories, formulations and manufacturing specifications related to the former "Glyptal" alkyd resin production of Schenectady, N. Y. In addition, technical information, technical service data and product development information will be given over to ADM for use at its research and development headquarters.

A number of G.E. employees from the Schenectady alkyd operations are expected to transfer.

MODELS IN METALLURGY: Achievements in the field of metallurgical research and development won for New Jersey Zinc Co. an invitation to participate in a display of outstanding inventions in the mining, metallurgy and metal working fields, sponsored by the U. S. Patent Office, October 15 to November 9. Above, the company is featuring seven of its major developments. Starting with a facsimile of the patent, each unit carries a description of the process, a flow sheet or photo to illustrate its operations, and samples of its end product.

NEWS

Augustus DeVos Dies; Was Industry Leader

Augustus R. DeVos, president since 1941 of Breinig Brothers, Inc. and a trade associations leader within his industry, died suddenly in his New York home on October 31. He was 65 years old.

A. R. Devos

Mr. DeVos had worked in the paint industry for the greater part of his life. Joining Breinig Brothers in 1933, he served the Hoboken, N.J. paint manufacturer as general manager until he became president.

Besides his company affiliations, Mr. DeVos was associated with several paint groups. He served as president of the New York Paint, Varnish and Lacquer Association from 1943 to 1944 and remained a member of the Presidential Advisory Committee for many years afterward. He was, additionally, the Regional Vice President for the New York area of the National Paint, Varnish and Lacquer Association, Inc., at the time of his death, and was one of the founders of the New York Paint Industry Credit Association.

Mr. DeVos was also a member of the National Association of Manufacturers, for which he served as chairman of the committee on distribution.

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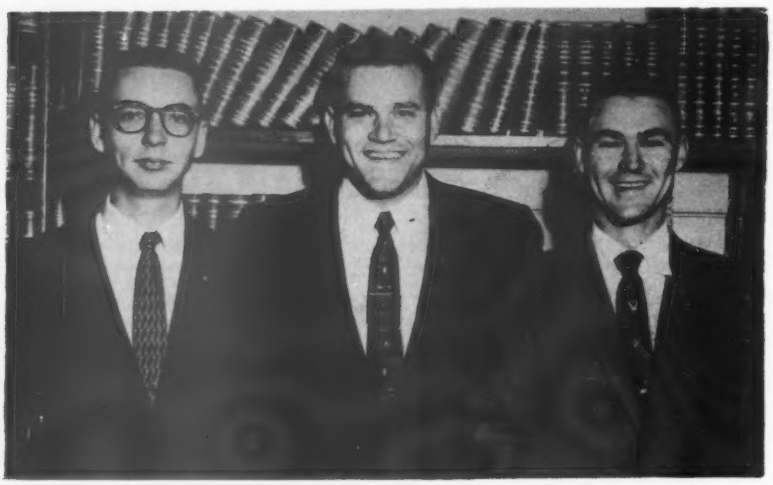
ADM Builds in Mexico

Archer-Daniels-Midland Co., Minneapolis, and a group of Mexican industrialists report the formation of a new company in Mexico City, Mexico to manufacture and market Archer formula feeds.

The enterprise, named Alimentos Y Concentrados Archer, SA, is owned equally by the American and Mexican groups. Plant operations are expected to begin this month when construction is completed.

FELLOWSHIP AWARDS: For the fourth year in succession the Ernest T. Trigg Foundation has presented research fellowship grants to deserving students for study at the Department of Paints, Varnishes and Lacquers, North Dakota Agricultural College, Fargo, N. D. Recipients of these grants, in the amount of $600 each, are pictured above. Left to right, they are: Joseph Fischer, Donald Kuske, Robert Tofte, and Jens Jorgensen.



PAINT SCHOLARS selected to receive $600 awards donated by the Benjamin Moore & Company of New York include: (left to right) Bruce Farnum, Martin Kalnins, and Robert Burke. Each of the students was carefully screened by company and college personnel before being chosen for the fellowship grants. The grants for study and research are to be used during the 1956-1957 academic year.

New Wrinkle Wins Claim

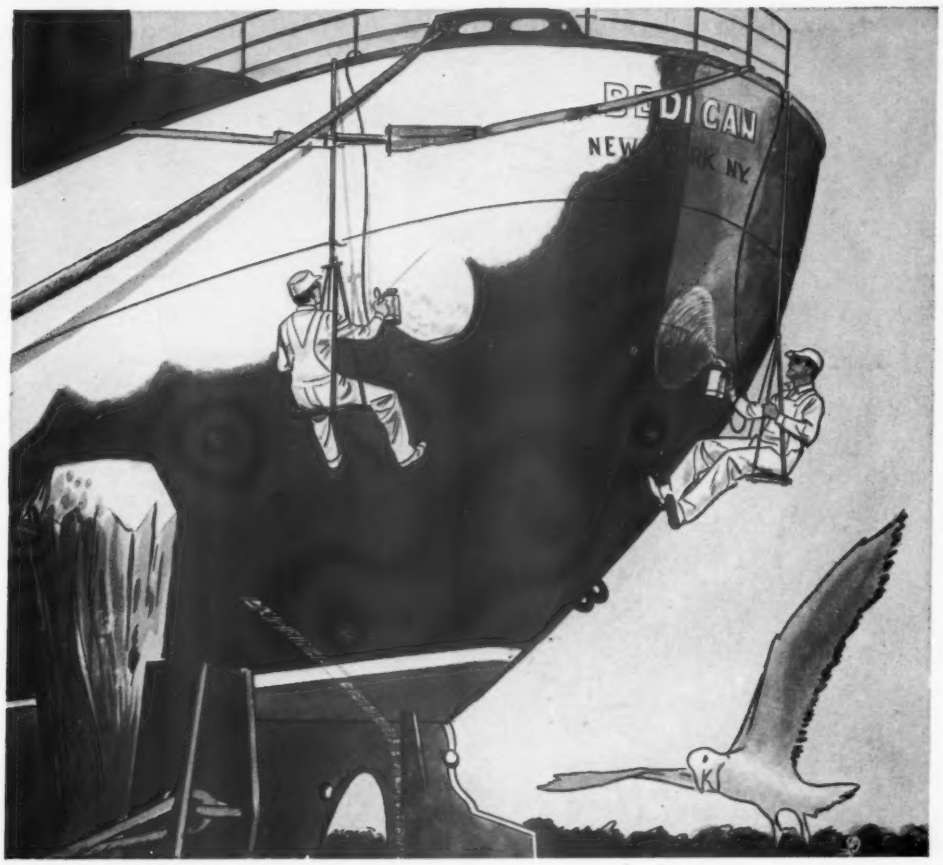
An out-of-court settlement with Tenax Finishing Specialties, Newark, N.J., awarding payment to New Wrinkle, Inc., Dayton, Ohio was announced last month. In making the settlement, Tenax acknowledged the fact that royalty payments were due the Dayton firm for the years 1954 and 1955.

Tenax had been under a licensing agreement with New Wrinkle, Inc. for rights to manufacture exclusive wrinkle finishes. New Wrinkle holds more than 80 patents on such finishes.

Jefferson Expands Plant

A major expansion of its petrochemicals plant at Port Neches, Tex., has been started by Jefferson Chemical Co. The program is reported to be by far the largest undertaken by the company since its formation in 1944.

Expansion is intended to increase production facilities for existing products, provide installations for the production of various raw materials now being purchased, and lead to the manufacture of several new products.



proved corrosion resistance with wash primers

The adhesive properties of Shawinigan Resins' FORMVAR and BUTVAR are especially valuable in "wash primers." Anti-corrosion primers of this type adhere better on metal surfaces and permit better adhesion of top coat to primed surfaces. This tenacious two-way adhesion provides better protection against corrosion.

These primers or metal conditioners have other important advantages over conventional materials. They apply easier, dry faster, resist abrasion and impact, and prevent underfilm corrosion. The wash primer protective coating of only 0.3 to 0.8 mil thickness is a tough, corrosion resistant conditioner for steel, aluminum, cadmium, tin, galvanized iron and magnesium. Formulation is easy in your regular pebble mill.

Wash primers have extended the life of metals in many applications and have opened profitable new markets for paint manufacturers. For full technical information, resin samples and suggested formulations, write Shawinigan Resins Corporation, Department 2212, Springfield 1, Massachusetts.

FORMVAR® *and* BUTVAR® *resins by*

SHAWINIGAN RESINS

HERCULES — the "Plus" PE

Quality Product + Modern Plants + Customer Service = Best PE Buy

32 trained Representatives
in 14 Sales Offices
Backed by Laboratory Staff
of 60 always available

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Bid . . . after bid . . . after bid

Call

Cargill

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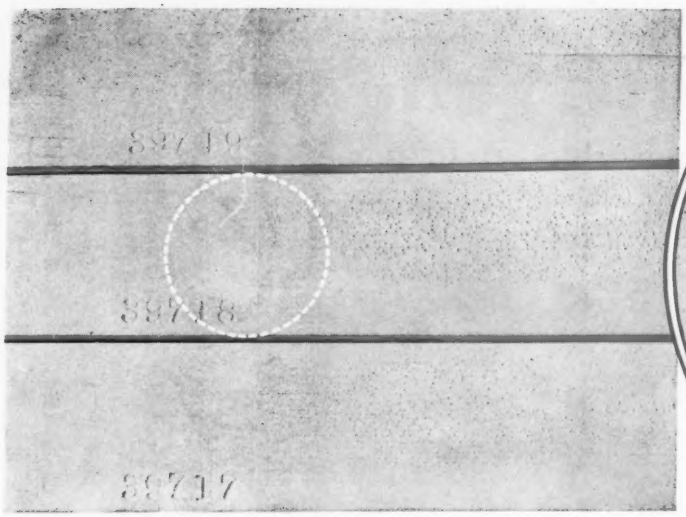
PRODUCT OF Cargill CREATIVE PROCESSING

Suppliers to the Paint and Varnish Industry

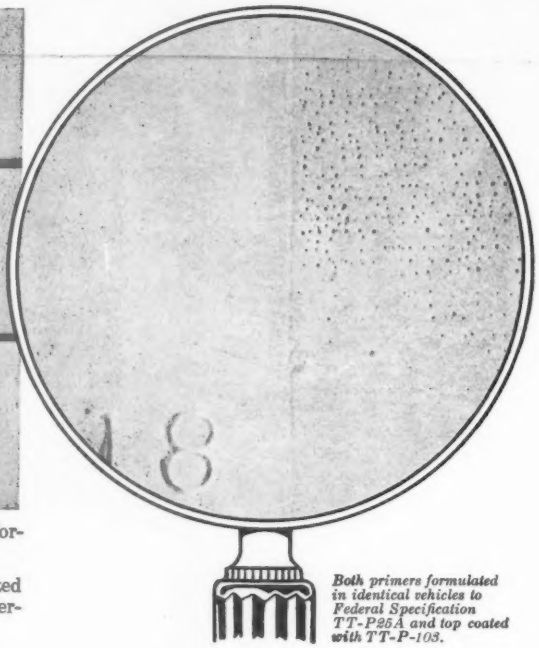
Linseed Oil • Soybean Oil • Fish Oil • Alkyd Resins • Specialty Products

Compare the difference in these two paint primers!



Test panels on left show that *no blistering* occurred in the paint primer formulated with Eagle-Picher Super Sublimed White Lead.

Test panels on right show definite *blistering* in the paint primer formulated with an equal volume of a highly reactive lead pigment. Compare the difference in the magnified area on extreme right.



Both primers formulated in identical vehicles to Federal Specification TT-P-25A and top coated with TT-P-103.

EAGLE-PICHER
SUPER SUBLIMED WHITE LEAD
provides greater blister resistance!

Accelerated tests prove that blistering—caused by loss of adhesion when moisture content is high—*does not occur* when quality house paint primers are formulated with Eagle-Picher Super Sublimed White Lead. Even under extremely adverse moisture conditions, these primers show very little water absorption, low volumetric swelling and superior adhesive characteristics.

Insure greater blister resistance in your house paint primers. Specify Eagle-Picher Super Sublimed White Lead. Remember, Eagle-Picher maintains rigid quality control from ore to finished pigment . . . and as the largest producer of *both* zinc and lead pigments provides unequalled and unbiased customer service!

THE FORMULATION

	Pounds per gal.
#41 Super Sublimed White Lead	4.64 lbs.
Titanium Dioxide—Rutile	1.13
Magnesium Silicate	3.41
Raw Linseed Oil	1.32
Z Linseed Oil	2.47
Mineral Spirits	1.62
24% Pb	.06
6% Mn	.03
	14.68 lbs.

PVC—35.5%

Since 1843

EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

Largest Producer of Both Zinc and Lead Pigments

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ARALDITE®

"first in epoxies"

BRINGS NEW COAST-TO-COAST BASIC RESIN SERVICE TO PAINT FORMULATORS

CIBA produces basic resins only, to be formulated for intermediate and end use.

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Geo. A. Rowley & Co., Inc.
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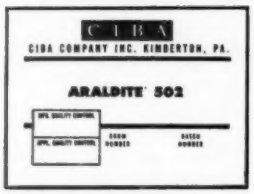
SURELY!



✔ Production Quality Control
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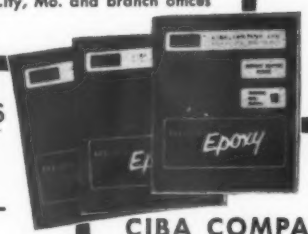
CIBA's Technical Service offers the most complete and up-to-date information on the properties and uses of Araldite Epoxy Resins. Write for new 40 page Technical Bulletin!



SURFACE COATING APPLICATIONS OF ARALDITE EPOXY RESINS

number	*uses*
6071 6075	Air dry finishes. Baked finishes. Extra thick coats at high solids. Corrosion-resistant finishes.
6084	General purpose esters. Lower cost. One package systems. Easy brushing.
6097 6099	Baked finishes for optimum resistance to chemicals, solvents and abrasion.

CIBA COMPANY INC. PVP-12

Plastics Division, Kimberton, Pennsylvania

Please send new bulletin No. 18 on Surface Coating Resins.

NAME_____

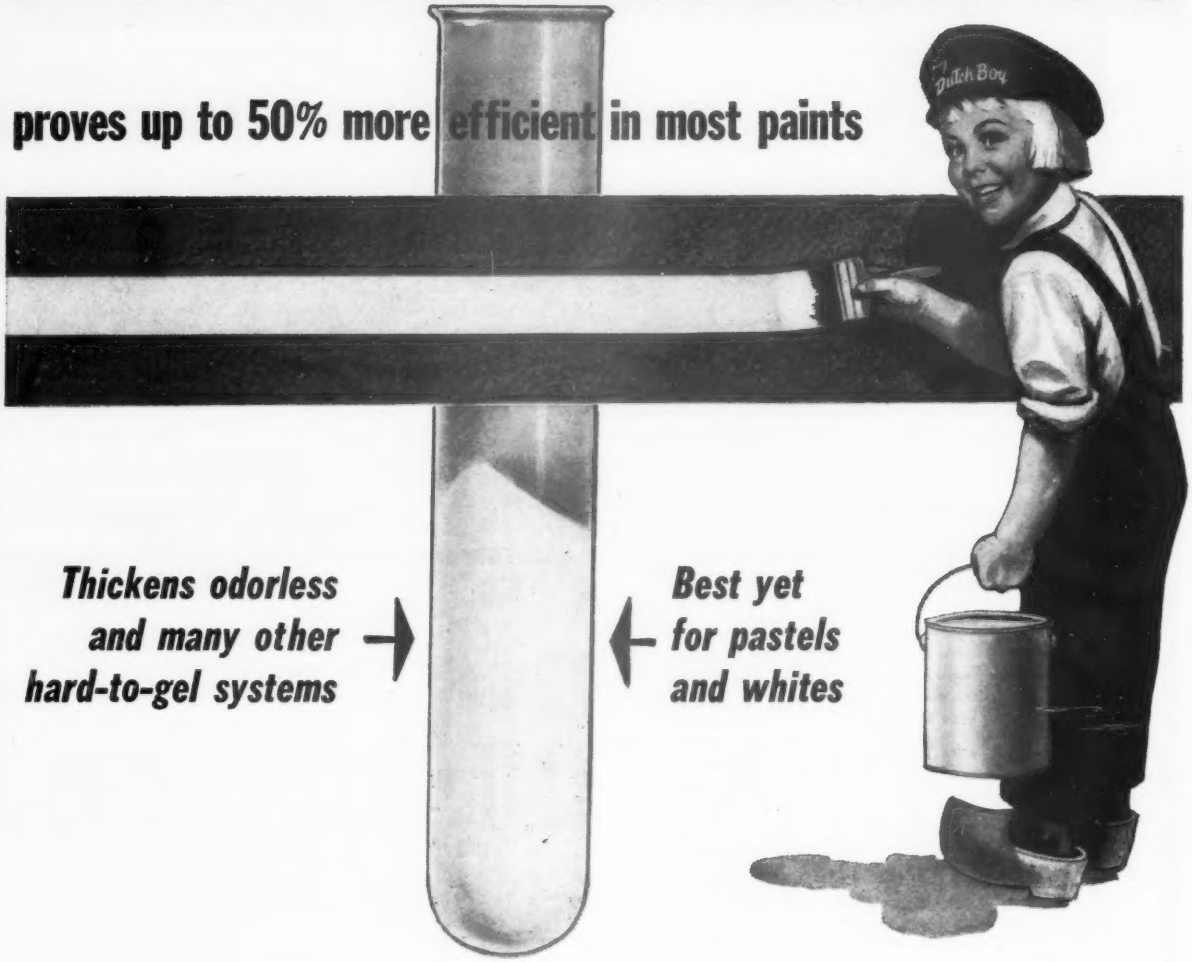
COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ STATE_____

New "Dutch Boy" gelling agent... BENTONE® 38

proves up to 50% more efficient in most paints



Now National Lead gellant research brings you BENTONE 38 . . . a brand-new "Dutch Boy" BENTONE that works wonders for paints.

For example, tests show that BENTONE 38 is up to 50% more efficient in bodying standard paints.

Proves highly versatile, too

Take odorless mineral spirits. Take lacquer thinners. BENTONE 38 produces stable, thixotropic gels in both. And in most in-between solvents. Thus it bodies odorless and other hard-to-gel paints with ease...brings them the familiar "Dutch Boy" BENTONE benefits.

BENTONE 38 *also improves many non-paint organic compounds . . . cosmetics, waxes, adhesives, non-systemic pharmaceuticals, to name a few.*

AIDS COLOR-SENSITIVE SYSTEMS

In pastels and whites, BENTONE 38 simplifies color compounding two ways. First, it is the lightest of all "short" gellants in color. Second, less need be added.

In enamels, varnishes, lacquers, BENTONE 38 aids color compounding, as above, and also provides less flatting action.

In baked finishes, vinyl resin systems, BENTONE 38 provides desirable low reactivity (and hence minimum discoloration) during the baking cycle. It also stops sag.

Want technical details? Write address below for just-published brochure.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal
1428 Granville Street, Vancouver 2, B. C.

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One Order! Get top-quality products made by America's leading producers . . . delivered in drums, tank trucks, transports or tank cars.

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No "paint" odor with RHOPLEX AC-33 *acrylic* emulsion

Emulsion paints based on RHOPLEX AC-33 *acrylic* emulsion are fast-drying . . . their mild clean odor disappears almost immediately after the paint is applied. RHOPLEX AC-33 not only adds odor-free salability to your paints, but also simplifies inventory problems since this one vehicle can be used to formulate both interior and exterior paints interchangeably.

RHOPLEX AC-33 is compatible with almost all types of pigments. Paints based on this *acrylic* vehicle have excellent storage stability. There is little pH drift or viscosity change on aging. RHOPLEX AC-33 gives paints excellent durability, color retentiveness, and resistance to water-spotting and attack by alkalis. Paints can be applied by brush, roller or sprayer to a variety of surfaces—old or new, wet or dry.

For more information on the many other sales and manufacturing advantages of RHOPLEX AC-33, write for detailed literature and sample, today.

RHOPLEX AC-33 *is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.*

Chemicals for Industry

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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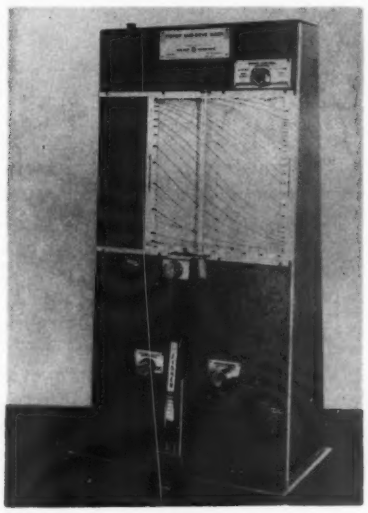
NEW MATERIALS & EQUIPMENT

A MONTHLY MARKET SURVEY

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



FISHER

SUB-SIEVE SIZER

Eases Particle Size Measurements

Redesigned sub-sieve sizer, used for routine determinations of average particle size of industrial and research products, is said to make operation of the instrument quicker, smoother and easier.

This instrument makes use of the fact that coareseness or fineness of a column of uniformly packed powder controls its resistance to the flow of dry air.

The theoretical equation for average particle diameter in microns involves 8 variables. By standardizing test conditions and using a chart, this instrument reduces this complex relationship to one direct measurement. Apparatus covers two ranges: 0.2 to 20 microns and 20-to-50 microns.

For complete details on this particle size measuring unit, contact Fisher Scientific, Dept. PVP, 384 Fisher Bldg., Pittsburgh 19, Pa.

ROSIN FATTY ACID

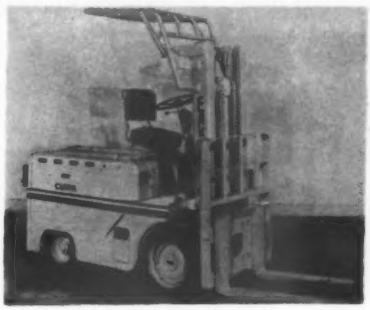
Improven Grades

Utilizing a new process, company announces new grades of rosin and tall oil based on tall oil.

According to the manufacturer, this rosin has following properties: color is lighter than X standard on the USDA scale; softening point and acid number are high; sulfur has been removed and characteristic odor usually associated with tall oil rosin is absent.

Unbleached fatty acids are claimed to have the following properties: max. color of 3 on Gardner 33 scale; rosin acids and unsaponifiables are lower than any previously produced with a correspondingly high acid number; heat stability is superior to other tall oil fatty acids.

Crosby Chemicals, Inc., Dept. PVP, Picayune, Miss.



CLARK

FORK-LIFT TRUCK

8,000 Lb. Capacity

The "EUT-8024," an 8,000 lb. capacity fork-lift truck with dual drive wheels, has just been introduced.

The new truck has a turning radius of 85 inches, aisle for right angle stacking (including 48-inch long load) of 148½ inches and overall length of 133 inches. Weight of the truck is 11,580 lbs. with a lead acid battery and 11,378 lbs. with an alkaline battery.

With four speeds forward and four reverse, the truck will travel loaded at 5½ mph and climb a 10 per cent grade. Power comes from a dual field, high-torque motor which is said to provide maximum efficiency under the most severe operating conditions. Electric Truck Section, Industrial Truck Division, Clark Equipment Co., Dept. PVP, Battle Creek, Mich.

GRAVITY INDICATOR

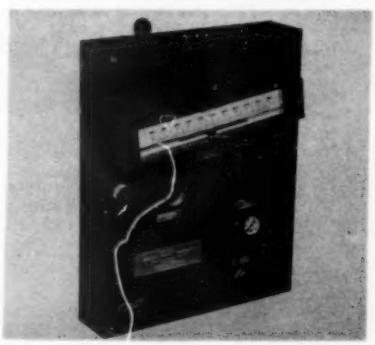
Remote Type

A new remote reading specific gravity indicator has been announced. Called "Specific Gravity Indicator No. 1561," it is a fully automatic instrument, with a reported accuracy of .001 Sp. G. units and an interpolation to .0005 sp. G. units.

The specific gravity indicator operates on the principle of a differential bubbler and has two static pick-up tubes (one a predetermined distance above the other) within the vessel containing liquid to be tested. Two additional tubes are installed in a small reference tank within the instrument.

For testing purposes, the reference tank is filled with a liquid of known specific gravity, which is selected to be as close as possible to the tested liquid. Both sets of static tubes terminate in a multiport valve which can connect either set of tubes with the indicating system. Petrometer Corp., Dept. PVP, 43-22 Tenth St., Long Island City 1, N. Y.

PETROMETER



NEW MATERIALS — EQUIPMENT

COPOLYMER EMULSION
Oil Type

A new paint vehicle, composed of chemically reacted drying oils in water, is claimed to offer a number of advantages over latex paints based on synthetic rubber chemicals.

Called "Arolon 110," the water emulsion is said to provide for easy application of paints, even to highly porous surfaces, and easy paint removal from brushes or rollers by simple rinsing under a faucet.

Additional advantages stated for the new product are high resistance to water, freezing and thawing, excellent adhesion to glossy surfaces, and a quick drying ability.

Company recommends use of Arolon 110 in primer-sealers and in flat and semi-gloss paints. Archer-Daniels-Midland Co., Dept. PVP, 700 Investors Building, Minneapolis 2, Minn.

THERMOMETER
Bi-Metallic Type

A new precision calibrated bi-metallic thermometer is claimed to measure, with perfect accuracy, any temperature between −40° and 1000° Fahrenheit or between −10° to plus 300° Centigrade.

DILLON

Dial housing of the new instrument measures 1-11/16″ and actual dial diameter is 1-7/16″. Model illustrated comes equipped with a plain bushing; however, 1/2″, 1/4″, 3/8″ N.P.T. or 3/8-24 x 1/2″ N.F. thread mounting nuts are all available optionally.

Stem lengths for the thermometer can be furnished from as short as 2½″ up to 70″ long. Crystals are curved, and all parts, (with exception of the dial which is totally enclosed), are made from type 304 stainless steel. W. C. Dillon & Co., Inc., Dept. PVP, 14620 Keswick St., Van Nuys, Calif.

SILICONE COPOLYMER
For Faster Baking Finishes

A new, fast curing silicone resin copolymer, "SR-120," is claimed to provide hard, glossy, heat resistant finishes which are superior to those of organic coatings. The new resin reportedly can be baked in 30 minutes at 400 degrees Fahrenheit.

Because it allows faster baking at lower temperatures, company says the resin copolymer will permit manufacturers using silicone finishes to speed up production lines on heaters, stoves, and other equipment on which heat resistant coatings are required.

SR-120 films can withstand continued exposure up to 440° F., according to the producer, and may be pigmented to obtain a wide diversity of colors. Silicone Products Department, PVP, General Electric Co., Waterford, N. Y.

look to HEYDEN and PENTEK®

Do you have a resin processing problem? If so, call one of Heyden's strategically located offices for prompt action from our technical service staff. We investigate your needs, then draw on our extensive knowledge of PENTEK (pentaerythritol, technical) to best fit them. Take advantage of the experience of Heyden resin chemists and their work in the applications laboratory improving products and increasing process efficiency.

Heyden manufactures a complete line of pentaerythritols for your specific needs:

PENTEK® (Pentaerythritol, Technical)—The "all purpose" polyol—best known name in pentaerythritols.

MONOPENTEK® (Monopentaerythritol)—For certain alkyds of lower or special viscosity.

DIPENTEK® (Dipentaerythritol, Technical)—For high viscosity vehicles and fast drying alkyds.

TRIPENTEK® (Tripentaerythritol, Technical)—For hard resins, varnishes and fast drying tall oil vehicles.

PENTAERYTHRITOL, Nitration Grade—Especially designed for manufacturing explosives and for use in organic syntheses.

TME® (Trimethylolethane)

For resins that demand these properties:
- Heat Resistance
- Color and Gloss Retention
- Hardness
- Alkali Resistance
- Resin Compatibility

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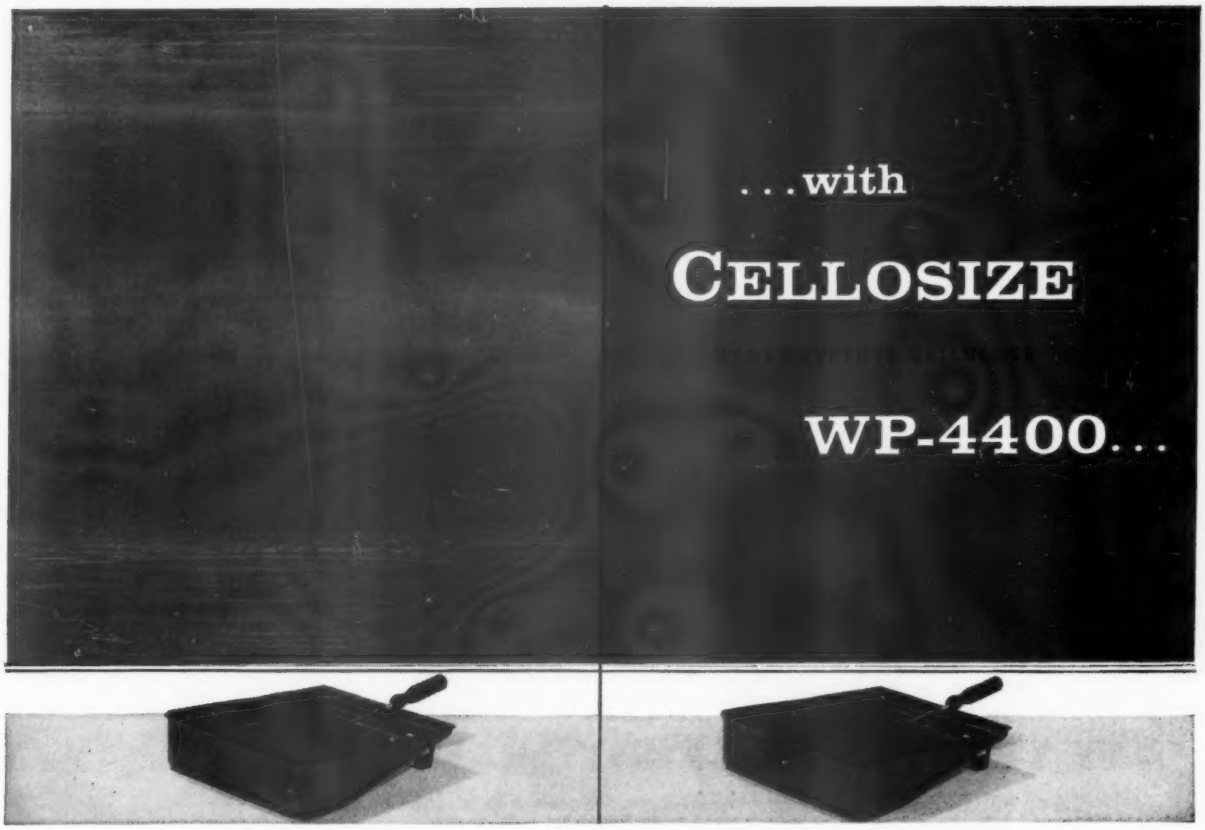
Parahydroxybenzoates • Pentaerythritols • Propyl Gallate • Resorcinol • Salicylates • Salicylic Acid • Sodium Benzoate • Sodium Formate

What a difference in latex paints . . .



Nonionic CELLOSIZE WP-4400 gives clean, bright colors with minimum sheen variation.

a new, nonionic, water soluble thickener

Your search for an excellent, nonionic, water soluble thickener for latex paints is over. The answer: CELLOSIZE Hydroxyethyl Cellulose WP-4400, a free-flowing, white powder. Its viscosity in 2% aqueous solution—3500-5000 cps. Look at the added advantages you get with this excellent thickener—

In Production

- *Goes into solution readily at room temperature—this saves you time and money*
- *Stability in presence of dissolved salts is outstanding*
- *Reduces foaming in mixing kettle*
- *Contributes to mechanical, freeze-thaw and viscosity stability*
- *Won't gel at elevated temperatures*

In Application

- *Contributes to better scrub resistance and washability*
- *Improves brushing, leveling, and flow-out*
- *Gives excellent color values, especially with popular deep decorator colors*
- *Reduces sheen variation*
- *Reduces pinholing*
- *Helps improve hiding power*

Now is the time to get your samples and technical data. Write to Carbide and Carbon Chemicals Company, Room 328, Dept. H, 30 E. 42nd Street, New York 17, New York.

In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal and Toronto.

The term "Cellosize" is a registered trademark of UCC

CARBIDE AND CARBON CHEMICALS

Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

here's the most efficient mixer developed in years

✔ *reduces mixing time over 50%*

✔ *always produces a superior mix*

DAY TWIN MOTION PONY MIXER

In recent field tests this new Day Mixer produced a superior mix in only 15 minutes, as compared to 35 minutes, required by a Day Single Motion Mixer.

Here's why: twin spindles, with counter rotating, overlapping blades, operate at new higher speeds. Adjustable scraper blade at edge of rotating can, moves material into orbit of agitator blades, affecting counter current mixing and eliminating all "dead spots". This multiplicity of movements gives a homogeneity of mix that will meet your most exacting requirements. Product contamination is eliminated, as there are no stuffing boxes or bearings in product zone. All the rugged construction, meticulous engineering, that has made the Day Single Motion Mixer the leader, is built into this new Day Mixer. Working capacities of 3, 10, 25, 40, 50, 80, 100, 125 gal.

For complete information write for Bulletin I-502-PM.

in mixing equipment FOUNDED 1907 **DAY** *means longer life span*

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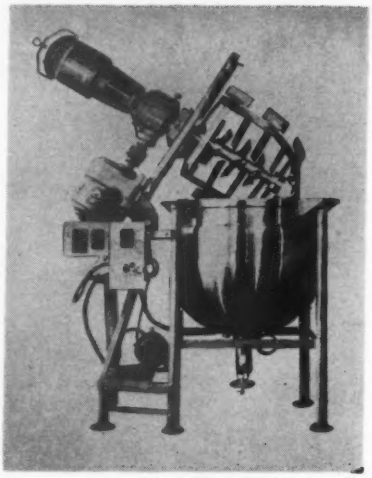
Division of Cleveland Automatic Machine Company

Quality equipment for baking, paint and varnish, printing ink, chemical, rubber, pharmaceutical, cosmetics, paper and pulp, explosives, food, ceramics, candy, soap, sugar and milk products.

MEXICO: T. de la Pena e Hijos, S.A., Nezas 45-A, Mexico 5—D.F.

NEW MATERIALS — EQUIPMENT



GIFFORD-WOOD

MIXER
Double Action Type

The double action "Agi-Mixer," for high speed mixing of fluid and semi-fluid substances, is said to complete its job up to 10 times as fast as conventional equipment.

Combining a set of counter-rotating paddles with the action of a high-speed homogenizer, the Agi-Mixer blends and homogenizes at the same time, according to company reports. The paddles work material down into the homogenizing zone, where the homogenizer subjects it to a refinement by hydraulic shear.

Production models of the Agi-Mixer are reported to handle up to 1,000 gallons of material in a single operation. Paddle mixer and homogenizer may be operated simultaneously or independently of each other. Gifford-Wood Co., Dept. PVP, Graybar Building, New York, N. Y.

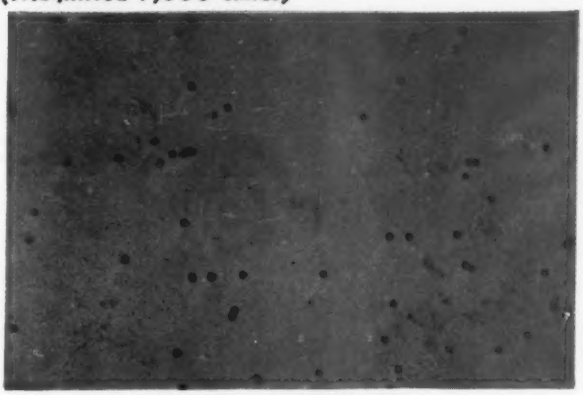
ANTI-SKINNING RESIN
For Tung Oil—Phenolic Varnish

A new agent for gelling and skinning control in the production of tung oil—phenolic varnish has been announced. Called "Nevillac Hard," it is reported to effect its dual advantages when used as a portion of the resin content in the varnish.

Company states that in its tests on a tung oil—phenolic varnish, "Nevillac Hard" at 10 to 20 per

NAUGATUCK ACETEX 2700

(Magnified 7,500 times)



Naugatuck ACETEX 2700
Vinyl acetate copolymer emulsion
(Average particle size: 0.2 microns)

Typical competitive copolymer
(Average particle size: 0.6 micron)

makes better paint at lower cost

THE TWO PHOTOMICROGRAPHS tell the ACETEX® story: an average particle size only one-third that of a typical competitive vinyl acetate copolymer! When used in PVA paint formulations, the much smaller particle size of Naugatuck Chemical's ACETEX 2700 emulsion produces:

- **Improved binding strength**
- **Greater durability**
- **Higher gloss**
- **Better water resistance**
- **Improved storage properties**
- **Greater film strength**
- **Lower raw material costs**

Write for more details including suggested formulations for interior wall paint, primer-sealer and exterior masonry paints based on this outstanding new latex.

United States Rubber

Naugatuck Chemical Division

Naugatuck, Connecticut

BRANCHES: Akron • Boston • Chicago • Memphis • New York • Philadelphia • **Mfg.:** Naugatuck • Gastonia • Los Angeles • **CANADA:** Latex Div., Dominion Rubber Co., Ltd., Montreal • **Cable:** Rubexport, N.Y. • Rubber Chemicals • Synthetic & Reclaimed Rubber • Plastics • Agricultural Chemicals • Latices

cent of the total resin proved a definite advantage. Simplification and control of the production process were said to be accomplished without loss of desirable varnish properties.

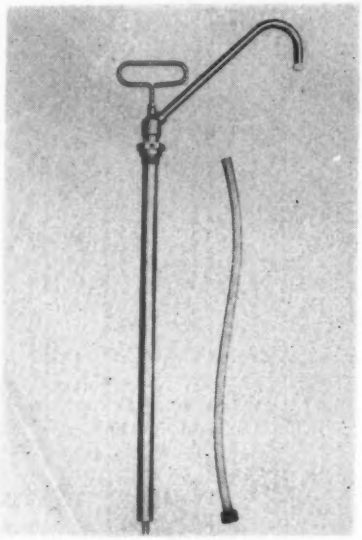
Possible expanded use of "Nevillac Hard" in tung or oiticica oil cooks with all other phenol-formaldehyde type resins is anticipated. Neville Chemical Co., Dept. PVP, Pittsburgh 25, Pa.

EMULSIFIER
For Latex Paint

"Witco 912" is a new combination of surface active agents specially developed for all emulsion type paints. Company claims it has proved highly efficient when tested in latex based paints of straight butadiene-styrene, PVA, and acrylic types, as well as those modified with alkyds.

The new emulsifier does not have the undesirable side effects obtained with older emulsifiers, according to the manufacturer. It is said that the thinning action usually imparted by other emulsifiers is minimized when Witco 912 is used.

An additional advantage is reported for latex paint systems employing Witco 912 as the emulsifier with methyl cellulose. Here the emulsifier is said to bring about a smooth product, by facilitating thorough and even incorporation of the methyl cellulose. Witco Chemical Co., Dept. PVP, 122 E. 42 St., New York 17, N. Y.



MULTI-METER

DISPENSING PUMP
For 15-65 Gallon Drums

A new Dispensing Pump, which reportedly is different from anything in its field, has been introduced. Designed to fit the standard ¾" opening on all size drums from 15 to 65 gallons, this new pump is entirely steel and chrome plated to prevent rusting, corrosion or any reaction with soaps, detergents, disinfectants, waxes, liquid fertilizers, and boiler chemicals.

Each stroke of the self-venting pump dispenses exactly four ounces, providing the user with a measured amount of material. Use of the pump is said to eliminate old fashioned drum racking, save floor space, and leave the drum always easily accessible. Multi-Meter Corp., Dept. PVP, Box 154, West Toledo Station, Toledo, Ohio.

PHOTOMETRIC UNIT
Measures Film Thicknesses

"The Quantum Ellipsometer" is a polarizing spectrometer that can measure directly the thickness of films deposited on suitable substrates in the range of from several to many hundred Angstroms. In so doing, it fills the gap between molecular layer dimensions and the point where other instrument readings are effective.

Use of this instrument is im-

Time Flies in ATLAS Weather-Ometers

Write for complete Weather-Ometer® catalog.

In developing new paint products—the new Atlas Weather-Ometer Model DMC will give accurate dependable forecasts of the weathering durability and color fastness of the product. Test programs can be exactly duplicated at any time to give accurate comparative data of various formulas.

For quality control in production — the Weather-Ometer is useful in maintaining the quality standard of the product, by checking each batch run for any deviation from the established weathering and light fastness standards.

Accuracy in test results is greatly increased in the DMC Weather-Ometer by a positive control of specimen temperatures. Automatic humidity control up to dew point is available as optional equipment.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid material and vertical panels for solids.

All automatic controls including complete voltage controls are located on the front panel above the test chamber door. Source of light is two Atlas enclosed violet carbon arcs.

ATLAS ELECTRIC DEVICES CO.
4114 N. Ravenswood Ave., Chicago 13, Illinois U. S. A.
Sales representatives in principal cities throughout the world.

FLOWS LIKE NEW AFTER 18 MONTHS.
Neoprene rubber-base coating produced by Gates Engineering Co., Wilmington, Delaware, shows no gelation after twice usual shelf-life.
Gaco
N-700
Liquid
NEOPRENE
COATING
Real Rubber in a can

Sunoco Toluene helps double shelf-life of neoprene rubber-base coatings

Unusual purity and consistent uniformity of Sunoco® Toluene are prime factors in new increased shelf-life of Gaco products.

Reason: *Sunoco Toluene is a purer-than-usual nitration-grade toluene.* It is sulfur-free, contains no gum-forming compounds. It typically contains no paraffins and only traces of olefins, if any at all.

Another point: The purity factors in Sunoco Toluene are *consistently the same*...very important in simplifying quality control and producing high-quality end products.

There is a technical bulletin giving complete specifications and other data about Sunoco Toluene. To get a copy, see your Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. PV-12.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

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NEW!

From P.V.O.'s Research and Development Division

METHYL LINOLEATES

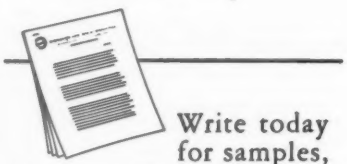
Methyl Linoleate-ML, Bleached Methyl Linoleate-MLB, Conjugated Methyl Linoleate-ML22—All Produced From Safflower Oil

Here are some of the important advantages these new vehicles offer polymer and alkyd manufacturers.

EXCELLENT PERFORMANCE—high percentage of non-yellowing linoleic esters, practically no linolenic, low saturated fatty acid content . . . fast drying, good color retention, better flexibility.

HIGH VERSATILITY—liquid form means easier handling . . . use requires no lengthy research . . . can be used with only slight modification in place of existing raw materials . . . cuts down polyol limitations.

LOW COST—low in cost compared with fatty acids . . . will sell in same range as Safflower oil . . . prices are based on the stable Safflower oil price.



Write today for samples, details, and free booklet!

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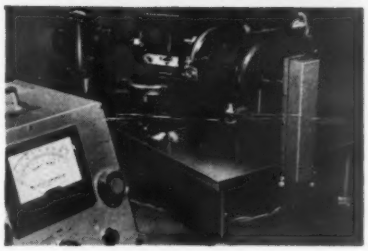
NEW MATERIALS — EQUIPMENT



QUANTUM

portant to fields where very thin films are to be examined, such as surface coatings, lubricating agents and adhesives. With it, new areas in the chemical, physical and biological sciences are possible, company claims.

The instrument is designed for both visual and photometric readings. An ultra-sensitive photomultiplier system is included which provides greater accuracy and reproducibility over visual observation. Quantum, Inc., Dept. PVP, 756 N. Brooksvale Rd., Chesire, Conn.

LATEX BINDER
For Exterior & Interior Paint

"Lytron 680," a new latex binder which may be formulated into latex paints for a broad range of exterior and interior uses, has been introduced. Company describes the binder as an interpolymer latex made from a combination of monomers.

"Lytron 680" is characterized as "non-toxic and non-irritating to the skin." Monsanto Chemical Co., Plastics Division, Dept. PVP, Springfield, Mass.

LOW-ROSIN FATTY ACID
Derived From Tall Oil

"Pamak 1," a low-rosin unsaturated fatty acid derived from tall oil, has been announced for use in the commercial production of tall oil fatty acid alkyds.

Company says that the new material provides satisfactory performance in the kettle, producing good reaction rates, pale colors, and adequate viscosities.

Enamels formulated with the resulting alkyds are claimed to have good drying and hardness properties. Hercules Powder Co., Dept. PVP, Wilmington 99, Del.

WETTING AGENT
In Liquid Form

Company announces that "Monawet MO-70%," a wetting agent and penetrant of di-octyl sodium sulfosuccinate, is now furnished in liquid form. According to manufacturer, this change facilitates handling of the material and results in a reduction of the processing cycle and, consequently, of production cost.

Use applications for Monawet MO-70% can be made by the paint, chemical and other industrial fields, where fast wetting and penetration are of prime importance. Information on the new product is available from Mona Industries, Inc., Dept. PVP, Paterson 17, N. J.

THICKENING AGENT
For Paint Removers

Company announces the addition of "Lauramide," lauric acid amide, to their product line. The new material finds use application as a thickening agent for inflammable-type paint and varnish removers.

As a thickening agent, it is claimed that Lauramide minimizes running on vertical surfaces, retards solvent evaporation and permits faster solvent penetration. Product is also said to be effective as an anti-blocking agent for vinyl copolymer type lacquers. Aceto Chemical Co., Inc., Dept. PVP, 40-40 Lawrence St., Flushing 54, N. Y.

PERSONNEL CHANGES

MONROE SANDER CORP.

Harold R. Tanney has been elected president and treasurer of the Monroe Sander Corp., Long Island City, N.Y., manufacturer of varnishes, lacquers, enamels, paints and synthetics.

Mr. Tanney, formerly vice president, has been with the company for the past nine years. He is a son-in-law of the late Monroe H. Sander, who founded the firm.

MARTIN-SENOUR

Alton H. Barnes has been promoted to sales manager of his company's eastern division, J. R. Degnan, Martin-Senour vice president, announced. Mr. Barnes, formerly manager of the Chicago sales division, replaces Thomas S. Andrews who earlier was named director of marketing.

The eastern division, with offices in New York City, covers New York, Maryland, eastern Pennsylvania, the New England area and the District of Columbia. The Martin-Senour general offices and plant are in Chicago.

PENNSALT CHEMICALS

Dr. Howard I. Cramer has been named Director, Technical Liaison, for Pennsalt Chemicals. In this capacity, he will further the company's interest in foreign technological developments and the exchange of scientific information both in this country and abroad.

Dr. Cramer received his early professional experience as a research chemist with the Goodyear Tire & Rubber Co. and later joined Sharples Chemicals Inc. In three years with Sharples he became Director of Development, the post he held when Sharples was acquired by Pennsalt.

COMMERCIAL SOLVENTS

Robert F. Purcell, protective coatings chemist, has joined the expanded nitroparaffins research staff of his company. He will make his headquarters at CSC's Research Laboratories in Terre Haute, Ind. and will specialize in application work pertaining to the use of nitroparaffins and derivatives in the protective coatings field.

R. F. Purcell

Mr. Purcell was formerly associated with the Sherwin-Williams Paint Co. in industrial sales and as a chemist. A graduate of Purdue University, he holds a B.S. degree in chemical engineering. He is also a member of the National Society of Corrosion Engineers.

VALSPAR

Frederick O. Vogenitz has recently been appointed manager of manufacturing by L. B. Hartnett, company president.

F. O. Vogenitz

Mr. Vogenitz brings to Valspar 18 years experience as chemist, plant manager, technical director, and research and development engineer. He will headquarter at Valspar's Lyons, Ill. plant and will direct all manufacturing procedures and new product development.

A graduate of Pratt Institute as a chemical engineer, Mr. Vogenitz also attended Yale University. Additionally, he is a fellow in the American Institute of chemists.

CELANESE

Joseph N. Mamola and **H. B. Bartley, Jr.,** have been chosen to head new sales offices of the Chemical Division of Celanese Corporation of America.

Mr. Mamola, who will be in charge of the Division's Detroit, Mich. office, formerly was a salesman operating out of the Cleveland and New York offices. Prior to joining Celanese in 1955, Mr. Mamola was a development chemist

Clean bright, fade-resistant solid colors, pastel shades and tints for exterior or interior use in oil or varnish vehicles. Soft in texture, easy wetting and grinding, high tint power and non-flocculating.

- A 8069 HANSA YELLOW TONER "G"
- A 8716 HANSA (Type) ORANGE TONER

Order a Trial Quantity

Experts in Color Technology for More Than a Century

H. KOHNSTAMM & CO., Inc.

89 Park Place, New York 7 11-13 Illinois Street, Chicago 11
2632 East 54 Street, Huntington Park, California

Branches in other principal cities of the U. S. A. and throughout the world

with American Seal-Kap Corp. and sales representative for National Adhesives Co.

Mr. Bartley, sales manager for a new Wilmington, Del. office, formerly was acting manager for the Division's Middle Atlantic sales district. Having joined Celanese in 1950, he was assigned to the New York district sales office in 1953 and then to the Middle Atlantic headquarters during the following year.

PETRO-TEX CHEMICAL

James O'Conner Brown, plant manager, Petro-Tex Chemical Corp., Houston, Tex., has been elected a vice-president of that company.

J. O. Brown

Mr. Brown has been associated with the Gulf Coast oil industry for over 40 years. He formerly worked his way up through the Sinclair Refining Co., going over to his present firm last year when Petro-Tex bought Sinclair's butadiene plant in Houston.

Petro-Tex is jointly owned by Tennessee Gas Transmission Co. and Food Machinery and Chemical Corp.

ALLIED CHEMICAL & DYE

Roger E. Caffier has been appointed as chemical sales representative in Rhode Island and Southern Massachusetts, according to an announcement by Barrett Division, Allied Chemical & Dye Corp.

Mr. Caffier graduated in 1951 from Lafayette College with a B.A. degree, and later served two years in the U. S. Coast Guard. He came to Barrett in September of this year.

GLIDDEN

Joseph C. Sherwood has been appointed technical service director for his company's Northwestern Industrial Department. In his new capacity, Mr. Sherwood will direct all Glidden technical service operations in Minnesota, Montana, Wyoming, North Dakota and South Dakota. He will headquarter at the firm's Northwestern Region paint plant in Minneapolis.

A chemical engineering graduate of Temple University, Mr. Sherwood formerly was assistant technical service director of the Glidden Company's Eastern Industrial Department in Reading, Pa. Prior to that, he had been a sales correspondent at Glidden's Nubian Industrial Division in Chicago, plant manager of the Chicago Division of the Glidden-owned McCloskey Varnish Co., and a research and development chemist with Rohm & Haas Co. in Philadelphia.

U. S. INDUSTRIAL

Martin Faye has been named manager of sodium product sales for U. S. Industrial Chemicals Co., a division of National Distillers Products Corp. In his new assignment Mr. Faye will be responsible for coordinating sales and sales promotional activities for metallic sodium, "U.S.I. Isosebacic" acid and related products.

Mr. Faye first joined the U.S.I.-National Distillers organization in 1952 in the Market Research and Development Departments. Previously, he was employed by the West Virginia Pulp and Paper Co.

"U.S.I. Isosebacic" acid, which Mr. Faye will now help promote, is the registered trade mark for a mixture of 10-carbon dibasic acid, produced synthetically for the first time by a U.S.I. developed process.

GEORGIA MARBLE

Robert F. Hall has been named technical service director for the Calcium Products Division of the Georgia Marble Co., Tate, Ga.

R. F. Hall

A production and laboratory paint chemist since 1937, Mr. Hall was formerly employed by the Garland Co., Cleveland, Ohio, and United Co-operatives, Inc., Alliance, Ohio.

Mr. Hall is a former president of the Cleveland Production Club, which he also served as council representative. Just recently, he completed a term as director of the Federation of Paint and Varnish Production Clubs.

Why this Hockmeyer Horizontal Paste Mixer brings you

3 IMPORTANT ADVANTAGES

1. Faster mixing
2. Greater efficiency
3. Easier cleaning

The Hockmeyer Horizontal Paste Mixer's 3 sets of mixing blades are specially designed, precision built. They eliminate "dead spots" and material build-up on tank sides. Their double rolling action agitates the batch into a homogenous mass in the shortest possible time. The unit is excellent for lead pastes, wood fillers, caulking compounds, color dispersions and other heavy, non-flowing materials. Its greater mixing efficiency provides a bonus in the form of lower horsepower requirements.

One of the Hockmeyer Horizontal Paste Mixer's most important advantages is that it is self-unloading. Its unusual mixing action pushes out even viscous, non-flowing materials; the bottom center gate outlet controls the rate of flow.

Cleaning this mixer is easy. Just place a solvent in the machine and start the motor.

The Hockmeyer Horizontal Paste Mixer is *safe* to use, too. All external moving parts are covered with a steel guard. A removable steel grating over the top opening prevents anything falling in and being caught in the blades.

The Hockmeyer Horizontal Paste Mixer is a valuable unit on both continuous and changing batch operations. Write today for free technical data sheet.

3 sets of blades touch every area of tank during mixing action!

HERMAN HOCKMEYER & CO.
341 COSTER ST., NEW YORK 59, N. Y.

Herman Hockmeyer and Company PVP-125
341 Coster St., New York 59, N. Y.

GENTLEMEN: Please send me your free, illustrated technical data sheet describing the Hockmeyer Horizontal Paste Mixer

My name_____
Company_____
Address_____
City_____ Zone____ State____

LYTRON* 680 is for both!

NEW AND UNIQUE LATEX BINDER IS BASIS FOR BOTH EXTERIOR AND INTERIOR PAINTS

superior in: weatherability and durability . . . early moisture resistance . . . resistance to chalking and blistering . . . flexibility . . . low temperature fusion . . . ease of application on masonry or previously painted wood . . . resistance to alkalinity.

Lytron 680 is now in full-scale production—available for immediate shipment in tank car quantities. Write for prices, complete technical data, and evaluation samples, to Monsanto Chemical Company, Plastics Division, Room 807 Springfield 2, Mass.

Where creative chemistry works wonders for you

MONSANTO

LYTRON: REG. U. S. PAT. OFF.

James Beckett

A. W. Chauncey

INTERCHEMICAL

James Beckett has been elected chairman of the Executive Committee of Interchemical Corp. and **A. Wallace Chauncey** has been elected vice chairman.

Mr. Beckett, formerly executive vice president, received his early training in the printing industry in England and joined Interchemical as manager of its Chicago printing ink factory in 1928. He served as general manager and vice president of its Printing Ink Division, and later as division president of its Finishes Division, before becoming executive vice president of the company in 1954.

Mr. Chauncey has been an officer, a member of the Executive Committee and of the Board of Trustees of Interchemical since it was organized in 1928. He had been a vice president of Phillip Ruxton, Inc., a printing ink company, when that organization merged with two other printing ink companies to form Interchemical. Then he served as vice president and treasurer of Interchemical until 1951, continuing as vice president until his new appointment.

PAUL O. ABBE

Robert E. Ringen has been selected sales manager by Paul O. Abbe, Inc., of Little Falls, N.J., manufacturer of ball and pebble mills, mixers, blenders, and dryers.

R. F. Ringen

Mr. Ringen brings to his new position a background which ranges from research and development work in the laboratory at Paul O. Abbe to his more recent sales engineering activities.

The new appointee is a graduate of Rutgers University, with a B.S. degree in mechanical engineering.

CARBIDE AND CARBON

Eighteen reassignments have been made in the Sales Department of Carbide and Carbon Chemicals Co., a Division of Union Carbide and Carbon Corp. A list of these follows:

As technical representatives, **D. J. Primavera** to the Boston District; **D. J. Kelly** to the Baltimore District; **C. W. Spagnuolo** to the Newark District; **M. G. Fielder** to the Miami District; **R. W. Halley** to the Los Angeles District; **W. H. Whyman** to the Buffalo District; **T. M. Fulton** to the Kansas City District; and **C. S. Mitch** to the St. Louis District.

Also as technical representatives, **J. T. Ferguson** to the New York District; **L. C. Kranefuss** to the Detroit District; **M. M. Maupin** to the Houston District; **F. R. Amport** and **R. T. Blake** to the Cleveland District; and **J. E. Sullivan** to the Cleveland District in behalf of the Special Products Department.

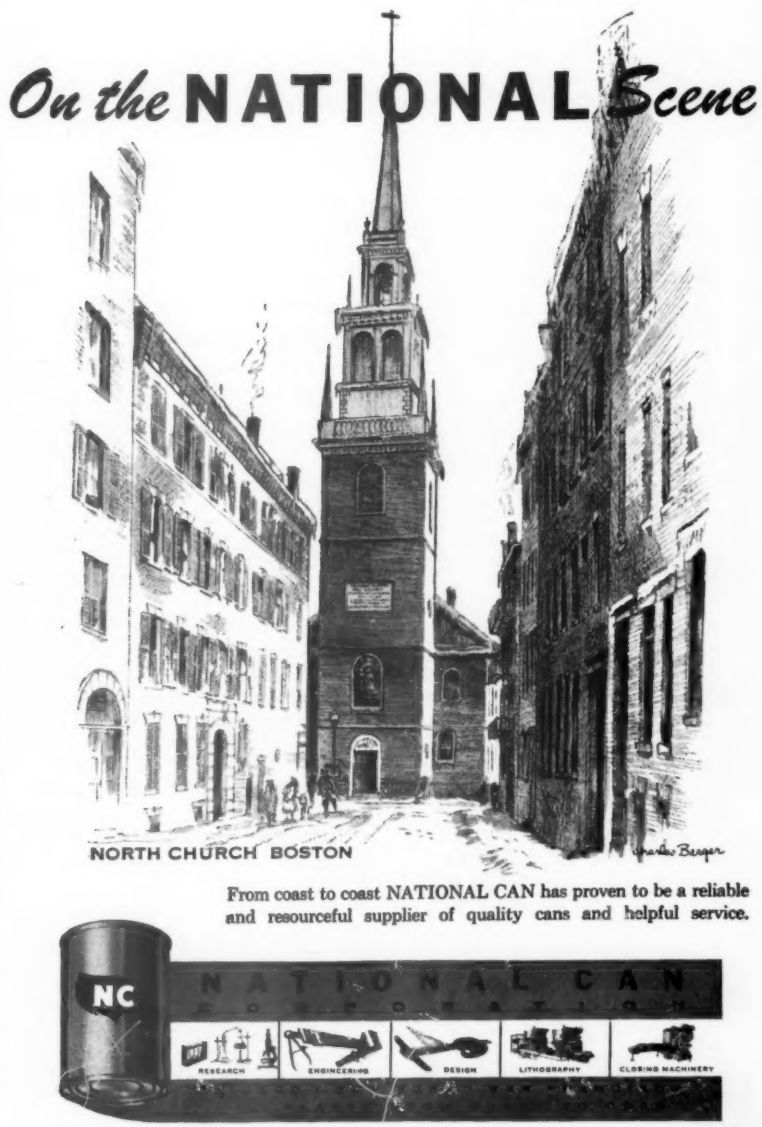
J. W. Nagel has been assigned to Seattle as district sales manager; **A. L. Merker** to the Philadelphia District as office manager; **J. D. Burger** to New York as supervisor in the General Sales Office; and **D. E. Francisco** to New York as a participant in sales control work.

GIFFORD-WOOD

Walter S. Roth has been appointed district manager for his company's new Cleveland, Ohio, sales office. He will be in charge of engineering, sales, and customer service on all Gifford-Wood's products in the Cleveland territory.

Mr. Roth has been with Gifford-Wood since 1949. Prior to his present appointment he was assigned to Gifford-Wood's sales offices in Chicago and in Hudson, N. Y., as a sales engineer.

The new district manager is a graduate of City College of New York, where he received his degree in mechanical engineering. He is also a member of the American Society of Mechanical Engineers.



WE HAD A PROBLEM

We had been well satisfied with our caulking compound—for drying, film and durability. To our consternation, it was reported that our caulking between the porcelain panels of a public building seemed to be accumulating dirt and discoloring. Yet a competitive product was holding its normal color... right next to ours!

WE WENT TO NUODEX

We took scrapings of both products from the building, and handed the problem over to Nuodex. Because of their experience with similar problems, Nuodex made an immediate recommendation—0.25% Super Ad-It®—awaiting the results of a thorough test of our compound. The cause of the discoloration was soon determined in the Nuodex Microbiological Laboratory—a profuse fungus growth known as *Pullularia pullulans*. Super Ad-It at 0.10% completely protected the caulking from this mold. Stronger concentrations were also recommended to us, to overcome mildew under more severe conditions. Our once "good" product is now *much* better.

CASE NO. F-910-SAI

YOU ARE INVITED

Nuodex invites you to call upon them for cooperative research on any paint problem—whether in current production or in new formulas, new vehicles, new developments of any type. This cooperative approach has proved mutually valuable on many occasions—an improved product for the paint manufacturer—another satisfied customer for Nuodex.

NUODEX PRODUCTS COMPANY

342 MADISON AVE., NEW YORK 17, N.Y.

J. J. Odom Jr.

W. T. Marshall

REICHHOLD

James J. Odom, Jr., who has been with the company since June, 1954, has just been appointed its Director of Technical Services at Tuscaloosa, Ala. In his new position, he will be active in the sale of RCI's entire line of products to industries throughout the South.

Mr. Odom first came to RCI from the National Gypsum Co. where he was a research engineer. Originally assigned to the surface coatings section of the Tuscaloosa Laboratories, he was subsequently promoted to District Sales Manager in New Orleans, prior to the current appointment.

William T. Marshall, a native of New York, will take over for Mr. Odom as New Orleans District Sales Manager.

An RCI sales representative in New Orleans for the past year, Mr. Marshall came to the chemical concern from C. T. Patterson Co., a New Orleans mill supplies firm. With C. T. Patterson he was a sales engineer.

GENERAL MILLS

Robert Shreve has been transferred from the O-Cel-O Division of General Mills, Inc. to the General Mills Research Laboratory in Minneapolis, Minn., where he will be Section Leader in the Chemical Engineering Department.

In addition, **Heinz Arnold** and **Howard Meindl** have newly joined the General Mills chemical research staff.

Mr. Arnold was previously with Merck and Co., Inc., before coming over to General Mills.

Mr. Meindl, who was graduated from college in 1954, is assuming his present position after serving for two years in the armed forces.

ARCHER-DANIELS-MIDLAND

Leslie J. Perrine has been assigned by the company as a technical sales engineer working out of the company's Los Angeles branch.

Mr. Perrine came to ADM at the time of the purchase of the resin division of the U. S. Industrial Chemical Co. Before entering U. S. Industrial Chemical's sales service laboratory in 1953, he was sales representative for the paint division of Pabco Products Inc., and manager of a branch store for Mathews Paint Co., Los Angeles.

PENNSYLVANIA INDUSTRIAL

Eugene C. Paschal, for the past two years a science teacher in Yellow Springs, Ohio, has joined the staff of the Philadelphia sales office of the Pennsylvania Industrial Chemical Corp. of Clairton, Pa.

Martin A. DeBerardinis has been transferred to the Jacksonville, Fla., sales office of Pennsylvania Industrial, after having spent two years in the firm's Chester, Pa., research laboratory and two years in sales from the Philadelphia office.

Dean F. Braun, formerly of the company's Chicago, Ill. sales staff, will be in charge of a new sales residency in Minneapolis, Minn.

GODFREY L. CABOT

Charles M. White has been named manager of a new Cabot sales office in Dallas, Tex. The newly opened branch is the sales office of Cabot Carbon Co., subsidiary of Godfrey L. Cabot, Inc., but will handle all parent company products.

C. M. White

Mr. White has spent three years with the company in the Chicago sales area and has a thorough background in the technical problems of the black and white pigments business. Before joining Cabot he was on the engineering staff of Hood Rubber Co.

DU PONT

Fred E. Walter has been appointed manager of production for the Fabrics Division of the Du Pont Company's Fabrics and Finishes Department in Wilmington, Del. He has been manager of Du Pont's Toledo, Ohio, finishes plant since 1955, and previously was manager of the Fort Madison, Iowa, finishes plant.

Along with Mr. Walter's appointment, the company announced a series of related appointments in the Fabrics and Finishes Department.

Charles C. Quenelle, manager of the Newburgh, N.Y., coated fabrics plant since 1950, will become manager of the Fairfield, Conn., coated fabrics plant.

Alfred J. Jennings, manager of the Fairfield, Conn., coated fabrics plant since 1952, will become manager of the Newburgh, N.Y., coated fabrics plant.

Harry L. Priddy, manager of the Parlin, N.J., finishes plant since 1947, will succeed Mr. Walter as manager of the Toledo finishes plant.

Robert H. Bell, assistant manager of the Philadelphia finishes plant, will succeed Mr. Priddy as manager of the Parlin finishes plant.

James K. Leahy, assistant manager of the Toledo finishes plant, will suc-

DRYING POWER IS REPEAT-SALES POWER

"Feeder" action of Nuact® Paste stops loss-of-dry

You know what happens when a customer buys a can of your paint that doesn't dry. You've lost a customer and jeopardized your brand reputation. Repeat sales are won or lost on warehouse floors and on dealers' shelves . . . and here Nuact Paste is a time-proved winner.

Nuact Paste is a patented lead compound with "feeder" drier action. Other methods of protecting dry are dangerous. Overloading with drier may cause wrinkling or skinning; better drier balance, with three or four driers, raises costs. The secret of Nuact Paste is that it becomes active slowly and in controlled amounts over extended periods of time. It features minimum settling, greater solubility and stability. In addition, Nuact Paste presents no dusting problem and actually adds to the paint yield.

Nuact Paste is strongly recommended for systems containing adsorptive pigments, particularly these bad actors: Carbon Blacks, Prussian Blues, Iron Oxides, Chrome Greens, Para, Toluidine and Lithol Reds, and Titanium Whites.

Rely on Nuact Paste for customer insurance—insurance against costly adjustments and that "silent loss of business" when paints fail to dry properly. Make a trial of Nuact Paste in your own paint and enamel systems. Write us direct for full information and samples, or contact your Nuodex Representative.

P. S. To inhibit loss-of-dry in lead-free systems, Nuodex Cobalt 254 is recommended.

NUODEX ADDITIVES
—TO MAKE GOOD PAINTS BETTER

THREE LITTLE BOTTLES THAT BUILT THE PLANT

NUODEX PRODUCTS COMPANY . . . 342 MADISON AVENUE, NEW YORK 17, N. Y.
A Division of Heyden Chemical Corporation
Export: Nuodex International, Inc., 511 Fifth Avenue, New York 17, N. Y.

Announcing! Increased plant capacity on

Oronite PHTHALIC ANHYDRIDE *plus*

new, large storage terminals at key national consuming points

Oronite was the original producer of phthalic anhydride from ortho-xylene, a petroleum derivative. Having complete control of the basic raw material, you are always assured of Oronite as a dependable source of supply.

With increasing demands for Oronite PA, manufacturing facilities have been greatly enlarged to assure you product when you need it. And to further provide you quick delivery of phthalic anhydride in molten or flake form, Oronite has set up bulk storage terminals in close-by Eastern centers. Carload prices are obtainable in mixed carloads of phthalic anhydride, maleic anhydride and new isophthalic.

Why not get Oronite's new, up to the minute story on phthalic anhydride? Call or write the nearest Oronite office.

"Basic Chemicals for Industry"

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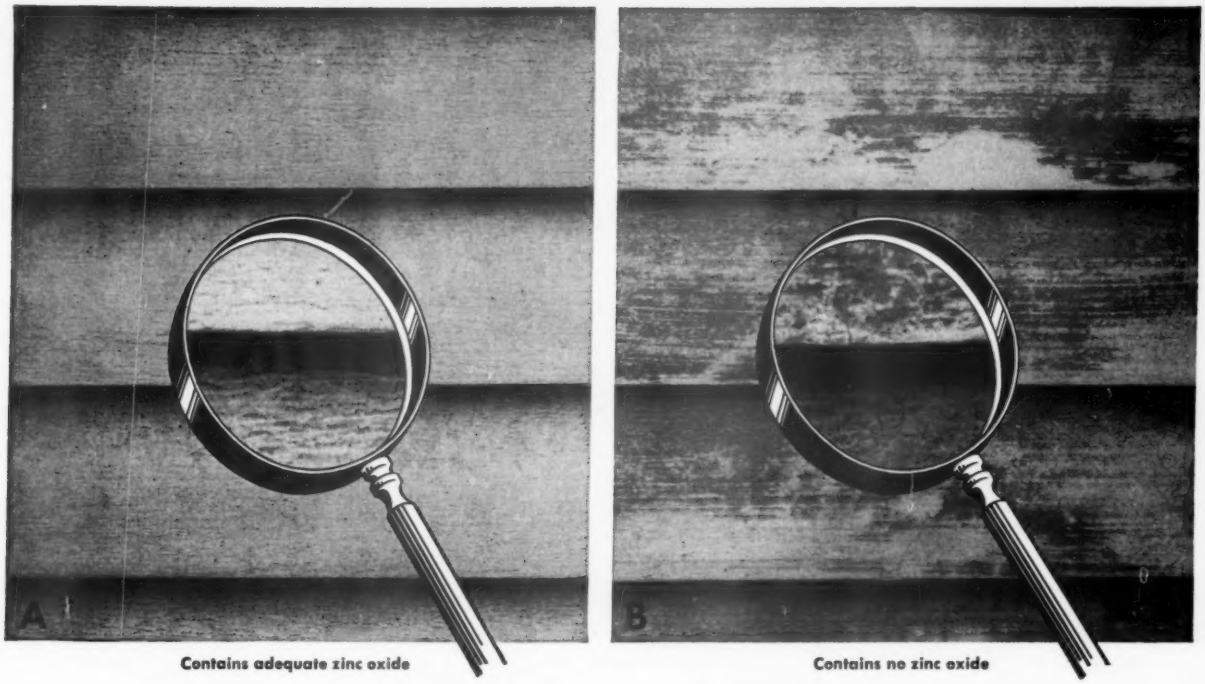
Mercantile Securities Building, Dallas 1, Texas — 450 Mission Street, San Francisco 5, Calif.
36 Avenue William-Favre, Geneva, Switzerland

ORONITE CHEMICAL COMPANY



Contains adequate zinc oxide

Contains no zinc oxide

Are you using enough ZINC OXIDE for

GOOD DURABILITY?

The above two clapboard sections, each coated with a linseed oil base exterior paint, were weathered for several years on a test fence in Eastern U. S. A., where erosion failures are common.

The difference: Paint A contains adequate zinc oxide content – Paint B contains *no* zinc oxide.

This test – and others made under widely varying conditions of climate and exposure – demonstrate that resistance to erosion, as well as good self-cleaning action, depends on adequate zinc oxide content. The unretouched photos above clearly show the characteristic film integrity of high-ZnO paints.

The qualities imparted to any good paint by adequate quantities of zinc oxide are well known . . . and time-proved. In balancing a formulation, zinc oxide levels must be kept high to insure customer satisfaction. With this in mind, consider:

Are you formulating your paints for maximum possible quality?
Are you formulating your paints with enough zinc oxide?

ENOUGH ZINC OXIDE GIVES YOUR PAINT . . .

- **DURABILITY**
- Mildew resistance
- Opacity to ultra-violet light
- Tint retention
- Self-cleaning action

Technical reports are now being prepared by member laboratories of AZI on the benefits of proper zinc oxide usage. To receive copies of these reports, mail coupon.

AZI

AMERICAN ZINC INSTITUTE, INC., Dept. B
60 East 42nd Street, New York 17, N. Y.

Please send me future reports on paint formulation findings.

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"A plasticizer for every purpose"

you can add a big selling point to your VINYL ACETATE PAINTS

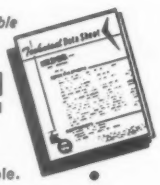
with permanent KRONISOL® plasticizer

A longer lasting, better than ever polyvinyl acetate paint is yours with KRONISOL plasticizer.

In addition to better permanence the use of KRONISOL plasticizer improves *gloss, ultra-violet light stability* and *adhesion* to cinder block, stucco or cement. *Coalescence* of the deposited paint film is markedly better. Other properties imparted by KRONISOL plasticizer are equally as good or better than dibutyl phthalate.

If you are now manufacturing, or considering the manufacture of polyvinyl acetate paints, a look at the properties of KRONISOL plasticizer means a step towards a better product.

Technical data and samples of KRONISOL plasticizer are available and will be sent immediately upon request.



fmc FOOD MACHINERY AND CHEMICAL CORPORATION

OHIO-APEX DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
NITRO, WEST VIRGINIA
Department 43

OHIO APEX fmc — PLASTICIZERS • CHEMICALS

☐ Send technical data. ☐ Send KRONISOL sample.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

ceed Mr. Bell as assistant plant manager at Philadelphia.

Coram E. Correll, service superintendent of the Parlin finishes plant, will succeed Mr. Leahy as assistant manager at Toledo.

NUODEX PRODUCTS

Michael J. Gluck has been appointed manager of overseas operations for Nuodex Products Co., a division of Heyden Chemical Corp. In addition, **John F. Lang** has been named vice president in charge of commercial development of Nuodex Products of Canada, Ltd.

Mr. Gluck had been associated with Mallinckrodt Chemical Works' export department as sales representative for the past four years, in which capacity he travelled extensively in Mexico, Central America and Cuba. Prior to that, he was with the export department of National Aniline Division of Allied Chemical & Dye Corp. for six years, three of which were spent in the European branch office.

Mr. Lang was previously manager of sales development for the Canadian branch of Nuodex. His new position will require him to direct an expanded market research and development program, aimed at diversification of Nuodex products in the plastics, petroleum and other chemical fields.

EMERY INDUSTRIES

Joseph Z. Sack has been assigned to the South Central sales territory for Emery Industries' Fatty Acid Sales Department. This territory includes the states of Missouri, Kansas Colorado, Nebraska, Oklahoma, Arkansas, Texas, western Louisiana, southern Illinois, and western Tennessee.

Mr. Sack received his B.S. degree from the University of Kentucky in 1950. In his new position he will be responsible for the sale of Emery's complete line of fatty acids.

Dr. J. D. Fitzpatrick has been selected as manager of the newly created Basic Research Section of Emery Industries, Inc. He will work in association with **Dr. Kenneth N. Warner.**

Dr. Fitzpatrick was manager of the New Chemicals Department of Emery from 1943 to 1952, at which time he was named to receive a Company Research Fellowship at the University of Cincinnati. His associate, Dr. Warner, is formerly of Emery's Organic Research Section.

A. C. Fusaro has been named Assistant Director of Advertising for the company. Mr. Fusaro joined Emery in 1947 as a member of its technical staff and has been associated with the advertising department since 1950.

You could fill volumes...

about products that benefit from Vinyl Monomers

Today, more and more industries are finding out that by starting with a Vinyl Monomer, they end up with an improved product.

Stronger adhesives and binders for non-woven fabrics. Water and grease resistant coatings for paper, leather and cloth. Vehicles for scrubbable water-base paints. Efficient emulsifying agents, textile sizes and specialty adhesives. Tough, transparent films, protective coatings and safety glass interlays.

Every one of these product improvements can be chalked up to the unusual properties and advantages gained through the use of Vinyl Monomers.

Three Vinyl Monomers — Celanese currently supplies industry with three basic vinyl monomers: Vinyl Acetate... Vinyl Propionate... and Methyl Isopropenyl Ketone. This versatile Celanese trio is already providing a rich source of product improvements and production economies. Additional Celanese monomers are under development. Perhaps we can help you make your product better. Celanese Corporation of America, Chemical Division, Dept. 558-L, 180 Madison Avenue, New York 16.

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Basic reasons..... .....for improved products

Acids	Functional Fluids	Polyols
Alcohols	Gasoline Additives	Plasticizers
Aldehydes	Glycols	Salts
Anhydrides	Ketones	Solvents
Esters	Oxides	Vinyl Monomers

Celanese CHEMICALS

Agricultural, automotive, aviation, building, electrical, paper, pharmaceutical, plastics, surface coatings, textile.

NEWS

Hercules Powder to Make Naval Stores in Mexico

Hercules Powder Co. has announced it will enter into the wood naval stores industry in Mexico for the recovery and utilization of pine stumps. Entry into this business was carried out through the acquisition of stock in Corbu Industrial, S.A., a Mexican corporation.

This is Hercules' first manufacturing venture in Latin America, although the company for many years has had a host of customers there for its chemical products. A new plant will be built near Ciudad Hidalgo, Michoacan, and will manufacture 25,000,000 pounds of wood naval stores products a year. Main offices of Corbu will be in Mexico City.

Hercules, producer of hundreds of chemicals for industry in 24 plants within the United States, is the world's largest producer of wood naval stores. Two plants in the United States—one in Brunswick, Ga., and another in Hattiesburg, Miss.—have been producing chemicals from pine stumps for more than 30 years.

The new Mexican venture will provide year-round employment for approximately 1,000 men, and will produce rosin, turpentine, pine oil, and other terpene chemicals, to be sold to Mexican industry and for export. Pine tar, a Corbu product since its inception in 1951, will continue to be made.

Ricardo B. Cordeiro, who founded Corbu Industrial in 1951, is general manager of the new and greatly expanded company resulting from Hercules participation. In addition to Hercules' backing, he is being given the assistance of Nacional Financiera, a government-sponsored agency for financing new Mexican industries.

Glidden Expands Program

Expansion of The Glidden Company's industrial wood finish program has been announced by A. D. Duncan, Glidden vice president and general manager of the Paint and Varnish Division. His announcement was made at an Industrial Paint Division conference in Cleveland.

The proposed program encompasses broadened research in the field of wood finishes and added technical service for Glidden customers. Glidden wood finishes and accessory products cover the field of furniture manufacture and allied industries.

Other phases of the Industrial Sales Conference included a seminar on application methods for wood finishes which was formed by top-ranking executives from process and equipment industries. Participating were E. A. Zahn, General Electric Co.; Dr. Emory P. Miller, Ransburg Corp.; and Harold C. Fornwall, DeVilbiss Corp. Topics covered were modern flow-coating, electrostatic spraying and catalytic spraying.

Two Firms Plan Merger

Simon Askin, president of Heyden Chemical Corp., and Armin A. Schlesinger, chairman of the board of Newport Industries, Inc., have announced that the managements of both companies are planning a corporate merger under the name of Heyden-Newport Chemical Corp.

The manner in which the companies will be combined is now under study by counsel and will be subject to the approval of the board of directors and stockholders of the two companies.

SYLOID® 162
Davison's NEW Alkyd-Urea Flatting Agent, for Synthetic Finishes, gives you
MORE FLATTING POWER AT LOWER COST
Laboratory tests and actual use tests have proven that SYLOID 162:
• can be ground in one-quarter the time required by other varnish flatting agents.
• the flatting power is two to three times greater than existing materials.
• twice as much can be ground in a single mill charge.
• the high and low tones are not destroyed as with present varnish flatting agents.
• films are tough, durable and mar resistant.
• has an exceptionally high chemical purity.
• chemical properties are controlled to insure uniform performance.
• there is no "seeding".
For further information on SYLOID 162—the alkyd-urea varnish flatting agent that gives you better performance at lower cost—write
Progress Through Chemistry
DAVISON CHEMICAL COMPANY
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Producers of Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizers.
W. R. GRACE & CO.

The terrible vengeance of Joseph P. Fyffe

ON A WARM August evening in 1870, a footsore stranger in naval officer's uniform walked into East Haddam, Conn.

His name was Joseph P. Fyffe, and he was revenging himself on the Navy for refusing to advance him travel money to proceed to his new station, San Francisco.

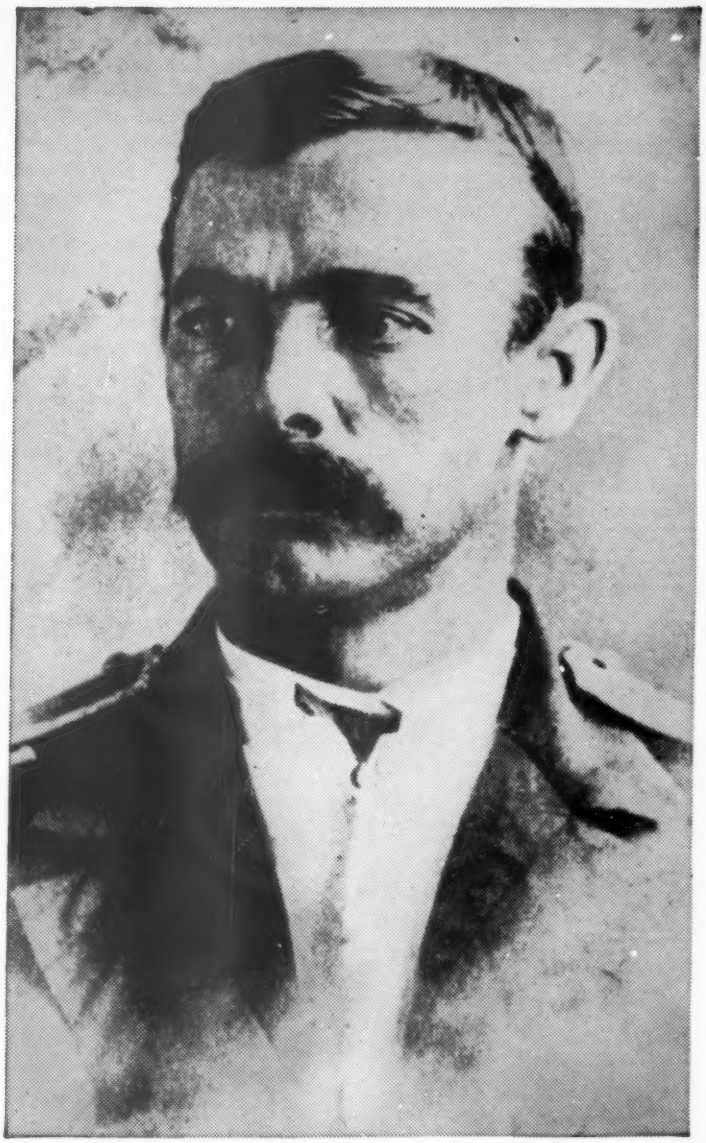
He was trudging cross-country *on foot.* And conscientiously wiring in daily progress reports well-calculated to give his superiors apoplexy. His sixth, from Albany, N.Y., read in part:

"Entered Albany barefooted X Comfortable X Earning my keep as bartender X Local rum far superior that served in Navy X Am sending sample"

At this, the Navy struck its colors, reversed its time-honored tradition, and began prepaying travel allowances.

Strangely enough, Joe Fyffe actually wound up as a rear admiral. That, of course, was years later; and he has long since passed to his reward. But his vigorous and outspoken independence is still alive and kicking in today's Americans. That's why our country is a strong, vital nation and why our country's Savings Bonds are one of the finest investments in the world.

165 million Americans stand behind U.S. Savings Bonds. *There is no better guarantee.* So buy Bonds regularly—and keep the ones you buy.



★ ★ ★

It's actually easy to save—when you buy Series E Savings Bonds through the Payroll Savings Plan. Once you've signed up at your pay office, your saving is done *for you.* The Bonds you receive pay good interest—3% a year, compounded half-yearly when held to maturity. And the longer you hold them, the better your return. Even after maturity, they go on earning 10 years more. So hold on to your Bonds! Join Payroll Savings today—or buy Bonds where you bank.

Safe as America – U.S. Savings Bonds

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LPG AS A TRUCK

(*From page 36*)

and half on gasoline for five months, carefully noting such factors as fuel consumption and maintenance costs. Results of the test are shown in the accompanying table. Douglas projected the savings on an annual basis covering all of its 103 handling units and estimated that a fleet-wide switch to LPG fuel would save $9560 a year. (See Table I).

A company long familiar with LPG as a fork truck fuel, Western Carloading Company, Los Angeles, converted a Clark Dynatork several years ago and reports that the unit operated 8000 hours before an overhaul was necessary, and that even then the parts required cost only $35. Similar machines operating on gasoline required rebuilding at 2000 hours with parts and machine work costing $250.

The same company, incidentally, saved $128 in oil costs on four trucks converted to LPG, and reports that spark plugs put in at the time of conversion four years ago are still being used.

At the Rochester, N. Y. plant of Gerber Products Company, manufacturer of baby foods, a fleet of 22 LPG fork trucks is in operation. Eight of them were factory built for LPG operation, the others were gasoline-powered machines converted to LPG at a cost of $175 each. Although the installation was only recently completed, total fleet maintenance costs have already reduced 15 per cent.

Some time ago the Korhumel Steel and Aluminum Company, Evanston, Ill., converted six of its 16 fork trucks at a cost of $1410. Seven months later the plant superintendent reported that "LPG has saved us at least $1800 in reduced maintenance and repair bills." Maintenance costs on the six LPG powered trucks were lowered 50 per cent; hourly fuel consumption on one carefully watched fork truck dropped from 1.7 gallons of gasoline to 1.3 gallons of LPG; oil filters last at least three months instead of being changed every two weeks.

At the Elizabeth, N. J., plant of Burry Biscuit Company, several gasoline powered fork trucks were converted to LPG for a three months test period. At the end of that time it was established that maintenance savings of about $180 per truck per year could be expected. Mileage tests proved that important fuel costs savings could be realized. A converted truck ran 13 hours on 6.82 gallons of LPG; the same model truck used 8.2 gallons of gasoline for the same period. Burry spends about 10c a gallon for LPG and about 25c a gallon for gasoline. Results of the test period induced Burry to adopt LPG for its entire fleet.

•

Cellofilm Is Sold

A change in ownership has been announced for Cellofilm Industries, Inc., producer of nitrocellulose base solutions. The firm had been operating as a jointly owned subsidiary of Universal, Paramount, and RKO motion picture companies, since its establishment in 1916.

The new purchasers will provide direct management of Cellofilm, as well as primary ownership responsibility. Henry Eysmann and Stanley Eysmann, long associated with the company, will remain under the new ownership, as will the technical staff. Arthur M. Golden, newly appointed executive vice president, will assume overall direction of company activities.

Superior Pigment Blacks

No. 32, No. 50, No. 100, Hitone, F-1, F-2, and F-3

Literature and samples on request

WITCO *36 Years of Growth*

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London and Manchester, England

NPVLA CONVENTION

(*From page 47*)

working properties that lacquers have for general furniture finishing.

The appliance industry was represented by E. L. Faneuf, manager, Chemical & Ceramic Research, Whirpool-Sugar Corp.

Mr. Faneuf outlined the advances which have taken place in the white appliance field during the last 25 years and discussed lacquers, alkyd finishes, urea and melamine finishes, and finally the epoxy-type coatings.

While many improvements have been made in organic finishes, they have some limitations, Mr. Faneuf said. Among them are color stability, heat stability, mar and scuff resistance, stain resistance, and corrosion resistance.

Another problem emphasized by Mr. Faneuf was how suppliers can improve their services. In this particular category he dealt with meeting delivery schedules, over and under shipping, passing on information to purchasing agents regarding price changes, passing on suggested economies, passing on technical information, reviewing existing manufacturing facilities and making recommendations for improving efficiency.

An important point brought out in this discussion was that plastisol coatings, plastics, and, of course, porcelain enamelling are competing for the appliance manufacturers' finishing dollar. Plastisols have found application in dishwashers, refrigerators and home freezers. Plastics of all types have been used on almost every appliance made, either as a decorative part or a working part.

The field of metal finishes was covered by H. W. Sacks of the E. F. Hauserman Company.

Mr. Sacks discussed the importance of test methods, particularly the interpretation of the test involved. He also stressed the importance of the end use of a product which should always be considered in testing finishes.

Hercules-Huron Merger

The boards of directors of Hercules Powder Co. and The Huron Milling Co. have approved a plan for the acquisition of Huron Milling by Hercules. Final action on the acquisition now awaits a vote of stockholders of The Huron Milling Co., which is located at Harbor Beach, Mich.

The plan calls for the acquisition by Hercules of all the assets of Huron in exchange for Hercules stock. Under the acquisition, Hercules would operate the Huron business as a division of its Virginia Cellulose Department.

Huron Milling, with more than 500 employees and net sales last year of approximately $12 million, processes wheat flour into proteins for food supplements, natural food flavoring, and wheat starch.

•

Shellac Studied For Uses

Shellac, which is best known as a wood finish and as a component of floor waxes, is being studied by technologists at Battelle Institute, Columbus, Ohio, to uncover additional uses for it.

The study is supported by the American Bleached Shellac Manufacturers' Assn., New York City. In this research Battelle technologists will not only seek new direct applications for shellac in its present form, but will also prepare chemical modifications for the development of broader applications.

For top quality and fast service specify—

NEVILLE resins, plasticizers, solvents

Neville Chemical Company of Pittsburgh has established a system of warehouses strategically placed to service the entire North American continent. This adds exceptionally prompt service to the advantages of using high-quality Neville products.

NEVILLE CHEMICAL COMPANY Pittsburgh 25, Pa.

NEVILLE

Neville Warehouse Locations

U.S.A.
Atlanta, Georgia
Boston (Medford), Mass.
Chicago, Illinois
Dallas, Texas
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Houston, Texas
Los Angeles, California
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
St. Louis, Missouri
San Francisco, California
South Kearny, New Jersey
Trenton, New Jersey

CANADA
Montreal, Quebec
Toronto, Ontario

MEXICO
Mexico, D.F.

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Interpolymer Latices

U. S. Patent 2,767,153. Ernest Alexander Sutton, Springfield, Mass., assignor to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware.

An aqueous interpolymer latex capable of drying to form a continuous adherent film at a temperature of about 10° C., said interpolymer being an interpolymer of (1) about 35-60 parts by we ght of an unsaturated ester taken from the group consisting of straight-chain and branched-chain saturated aliphatic alcohol esters of acrylic and methacrylic acid containing a total of about 5-20 carbon atoms in the alcohol radical of which about 5-14 carbon atoms comprise the longest continuous chain thereof, (2) about 3-10 parts by weight of an unsaturated nitrile taken from the group consisting of acrylonitrile and methacrylontrile, (3) about 2-5 parts by weight of an unsaturated monocarboxylic acid taken from the group consisting of acrylic acid, methacrylic acid, cinnamic acid, atropic acid and crotonic acid and, correspondingly, (4) about 60-25 parts by weight of a monovinylidene aromatic hydrocarbon, the interpolymer particles in said latex having an average diameter of about 0.1 to 0.5 micron.

Do you recall YELLOW OCHRE?

THE SCENE: *southern France.* The year: *1890.* These men laboriously wheeled casks of REICHARD-COULSTON yellow ochre into a freight car for shipment to America.

Even in those days, forward-looking paint formulators knew they could count on the quality of REICHARD-COULSTON ochres and other products.

... That is how it was done three quarters of a century ago. Since then, many changes have taken place in the paint industry. One of these is the development of chemically produced REICHARD-COULSTON IROX Yellows for use in the modern formulae of today – replacing the hard grinding, tinctorially weak ochres.

REICHARD-COULSTON IROX Yellows are popular because of their rich top tones and clean, chromy tints, fine particle size, extra low water soluble salts content and ease of dispersion.

What is true of REICHARD-COULSTON IROX Yellows applies equally to other REICHARD-COULSTON products such as IROX and SOFTEX reds, ERCO RECO and Chestnut Browns and the whole range of REICHARD-COULSTON pigments.

Chances are that REICHARD-COULSTON pigments can help *your* production. Look into it. For free laboratory samples and technical data, write today.

Natural IRON OXIDE PIGMENTS Synthetic

Reichard-Coulston, Inc.

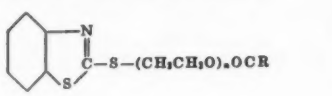
15 EAST 26th STREET, NEW YORK 10, N. Y.

Warehouses in principal cities. Factory: Bethlehem, Pa. Over a century of manufacturing and service.

Vinyl Chloride Polymers

U. S. Patent 2,762,786. Joachim Dazzi, Dayton, Ohio, assignor to Monsanto Chemical Co., St. Louis, Mo., a corporation of Delaware.

A resinous composition comprising a polymeric material selected from the class consisting of polyvinyl chloride and a copolymer of at least 70% by weight of vinyl chloride and up to 30% by weight of an unsaturated monomer copolymerizable therewith, said polymeric material being plasticized with an ester having the general formula



U. S. Patent No. 2,762,786

in which *n* is an integer of from 1 to 3 and R is a member of the group consisting of alkyl, aryl, aralkyl and cycloalkyl radicals of from 4 to 12 carbon atoms.

Applying A Decorative Coating To A Surface

U. S. Patent 2,768,093. Walter P. Ericks, Lockport, N. Y., assignor to The Upson Company, Lockport, N. Y., a corporation of New York.

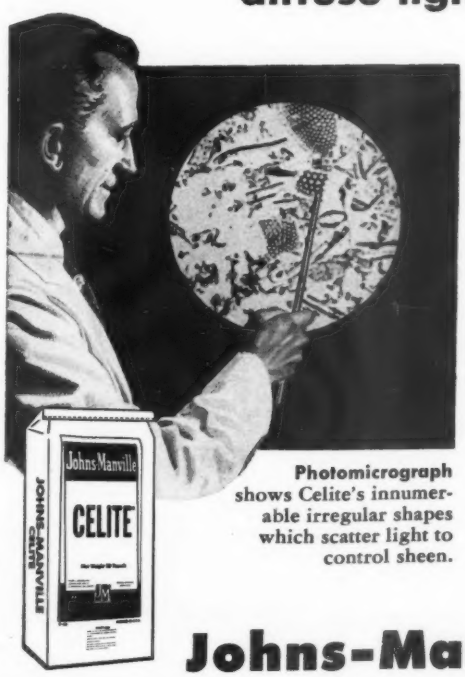
The method of coating a surface comprising the steps of covering said surface with a continuous base coating composed mainly of a pigmented resinous material dissolved in a hydrophobic organic solvent and applying over said base coating, while wet, a composition comprising relatively small, discrete, solid particles of cellulose material having a major dimension between about 0.01 and about 0.1 of an inch, said particles being coated with a solution of pigmented resinous material immiscible in water and dispersed in a medium composed mainly of water.

Emulsifiable Polyethylene Waxes

U. S. Patent 2,766,214. Michael Erchak, Jr., Morris Township, Morris County, and Robert J. Blazek, Morris Plains, N.J. assignors to Allied Chemical & Dye Corp., New York, N. Y., a corporation of New York.

A process for preparing readily emulsifiable polyethylene type waxes which comprises reacting a polyethylene wax containing in its structure at least one member of a group consisting of a telomeric alcohol group, an ester group, a hologen group, and a terminal vinyl group, with at least about 2% by weight, based on the weight of the mixture, of an unsaturated aliphatic polycarboxylic acid having from 4 to 6 carbon atoms inclusive at least one of whose active carbonyl groups is attached to a doubly bound carbon, at temperatures between about 175° C. and about 300° C.

CELITE diatomite pigments diffuse light and control reflection



Photomicrograph shows Celite's innumerable irregular shapes which scatter light to control sheen.

A soft uniform flatness, even at low angles, is the beautiful result of formulating interior paints with Celite*. By forming a rich textured film that diffuses rather than reflects light, these microscopic particles assure an attractive flat appearance indefinitely. The surface never rubs up shiny. These same irregular particles also impart "tooth" to the film for strong, lasting adhesion to any surface.

Celite is diatomite, an extremely tough form of amorphous silica, that reinforces the paint film. And, the micro-porosity imparted by Celite checks blistering and peeling by aiding the escape of moisture vapor from unpainted plaster.

If you're concerned about low angle sheen, find out how Celite can give you complete control of this problem. Write for further information to Johns-Manville, Box 60, New York 16, N. Y. In Canada, 565 Lakeshore Rd. E., Port Credit, Ont.

JOHNS-MANVILLE JM PRODUCTS

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products

Johns-Manville CELITE

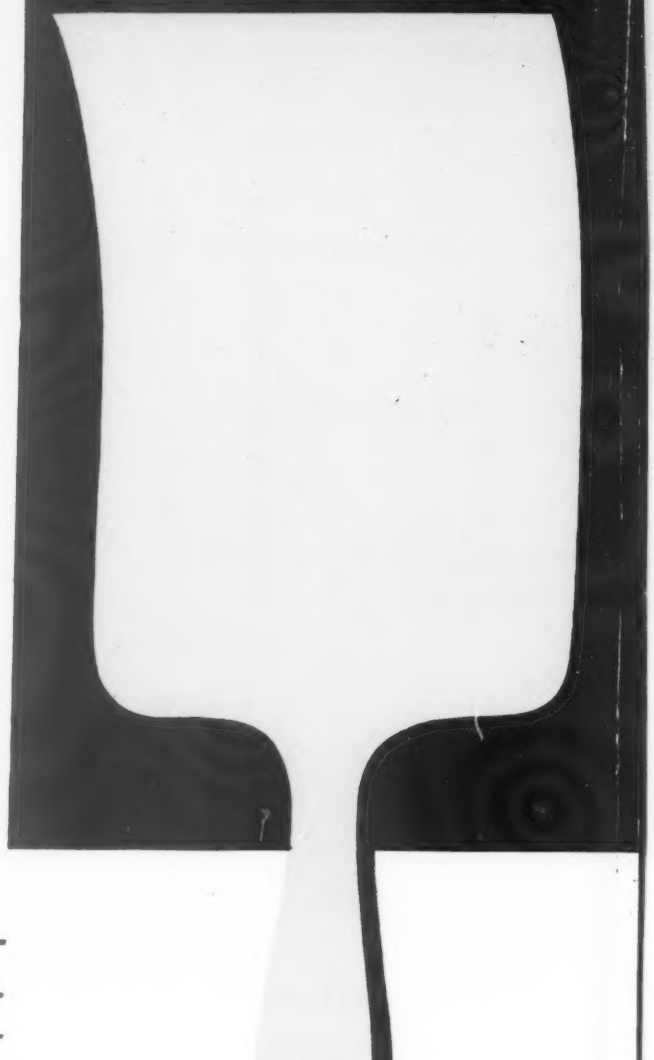
THE EXTENDER PIGMENTS FOR ALL COATINGS

DU PONT

ZINC YELLOW

Y-539-D HIGH CHROMATE TYPE

for { **STRUCTURAL STEEL**
DECORATIVE FINISHES
ALUMINUM and NON-FERROUS ALLOYS



ZINC YELLOW Y-539-D meets the requirements of all Zinc Yellow specifications. Tested and proved through wide use in Aeronautical primers MIL-P-6889b, MIL-P-8585, Ship primer JAN-P-735 and other specification primers. Gives lightfast decorative finishes . . . nonstaining in industrial atmospheres. For more information, see your Du Pont salesman, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington, Delaware.

DU PONT
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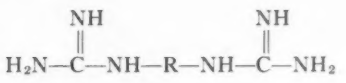
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT
COLORS
FOR QUALITY PRODUCTION

Pigmented Lacquers

U. S. Patent 2,767,154. Adolf Weihe, Kronberg (Taunus), Germany, assignor to Deutsche Gold- und Siber-Scheideanstalt vormals Roessler, Frankfurt, Germany.

A method of producing a pigmented lacquer which comprises friction rolling an admixture comprising a pigment, a hydrocarbon soluble film-forming non-hardening high molecular weight polymer selected from the group consisting of hydrocarbon soluble cyclized natural rubber and hydrocarbon soluble vinyl polymers, and a bisquanide of the formula



in which R is a radical selected from the group consisting of saturated aliphatic, aromatic, aliphatic aromatic hydrocarbon radicals until a homogenized rolled pigmented mass is obtained and dispersing said rolled pigmented mass in a lacquer containing a solvent substantially consisting of at least one hydrocarbon compound.

Method of Coating Surface With Transparent Film

U. S. Patent 2,768,909. John H. Haslam, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del., a corporation of Delaware.

A method of coating a solid surface with an insoluble, transparent, flexible, adherent polymeric oxide film not more than one micron thick, which comprises applying to said surface a layer of a hydrolyzable organic ester containing from 1 to 8 carbon atoms per organic radical of a metal from the group consisting of titanium and zirconium containing from about .0003 to .0375 gram molecule of ester per square meter of said surface, and contacting the applied ester layer, while having present therein not more than a minor amount of a volatile solvent for said ester, with water vapor until substantial hydrolysis and polymerization of said ester on said surface is effected.

Coating Containing Tar Pitch And Epoxy Resin

U. S. Patent 2,765,288. Fred Whittier and Raymond J. Lawn, Pittsburgh, Pa., assignors to Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., a corporation of Pennsylvania.

A cold setting bituminous composition comprising coal tar pitch substantially insoluble in alkali, ethanol, and isopropanol, an epoxy ether resin having a 1,2-epoxy equivalency greater than 1 and a curing agent for said epoxy ether resin, wherein said epoxy ether resin is between 15% and 80% of the mixture of epoxy ether resin and said coal tar pitch.

Stabilizing Drying Oils

U. S. Patent 2,767,229. Anthony H. Gleason, Westfield, N. J., assignor to Esso Research & Engineering Company, a corporation of Delaware.

A process for preparing a drying oil which comprises copolymerizing a mixture of from 75 to 85% of butadiene and 25 to 15% of styrene in 200 to 300 parts of a hydrocarbon diluent per 100 parts of monomers and 20 to 30 parts of a member of the group consisting of aliphatic ethers of 4 to 8 carbon atoms and cyclic diethers of 4 to 8 carbon atoms, in the presence of 1 to 5 parts of finely divided sodium at a temperature between 40 and 85° C., continuing the polymerization until substantially 100% conversion is reached and a product having an intrinsic viscosity between 0.05 and 0.4 is obtained, stopping the polymerization by killing and removing the catalyst and then heat bodying the product at a temperature between 150° and 275° C., in the presence of 0.001 to 0.3% of an alkylated phenol.

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NEWS

Southern Paint Clubbers Plan Florida Convention

Parker W. Layman, President of the Southern Paint & Varnish Production Club, has announced that plans are being completed for their 21st annual convention, to be held April 10-13, 1957 at the Soreno Hotel, St. Petersburg, Fla.

At a meeting of the Club Advisory Committee, held in Atlanta September 21, the various committee Chairmen reported on their phase of the plans.

The Southern Paint & Varnish Production Club will hold its 21st annual meeting next April at the Soreno Hotel (above) in St. Petersburg, Fla.

Registration will be under the direction of Secretary-Treasurer, C. B. Thomas, who will be assisted by members of the Executive Committee. Registration will begin on the afternoon of April 10.

R. B. McGoogan, Jr., Chairman of the Machinery and Raw Material Exhibit, reported an indication of an early sellout with 50 of the available 55 spaces already sold to 32 exhibitors. It is planned for the Machinery and Raw Material Exhibit to be opened on the afternoon of Registration Day.

Details for the Convention program have not yet been fully worked out by Ross McKenzie, President-Elect and Chairman of the Program Committee. However, the Convention will officially open on the morning of April 11, with a principal address, followed in the afternoon by technical sessions. The annual business meeting of the Club will be held on the morning of April 12, with additional technical sessions in the afternoon.

The Convention will officially close with a banquet and informal dance on the evening of April 12.

•

O'Brien Plans 25% Gain

The O'Brien Corp. announces it will increase its nationwide paint production capacity 25 per cent through a $500,000 expansion of its South Bend, Ind., headquarters.

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NEWS

Retail Paint Group Names Officers at Annual Meeting

Noah Adelsohn, Clinton Paint and Supply, Inc., Newark, N.J. was elected president of the Retail Paint and Wallpaper Distributors of America, Inc., at the conclusion of their national convention in Chicago last month. He succeeds C. E. McClelland, San Jose Paint & Wallpaper Co., San Jose, Calif., who was elected to the advisory committee.

William H. Bergman, S. A. Bergman, Inc., Chicago, was elected vice president, succeeding Mr. Adelsohn. Mr. Bergman was chairman of this year's ninth annual convention, the most successful in the Association's history. William B. Webster, the Wolverine Paint & Supply Co., Grand Rapids, Mich. was re-elected treasurer.

New directors of the Association, who were elected for three year terms, are: Benjamin H. Slade, Wescott, Slade and Balcom Co., Providence, R.I.; Paul M. Clark, Phelps-Clark Corp., Pasadena, Calif.; Michael Benaquista, Manchester Paint Co., Pittsburgh, Pa. and Robert Wilke, Sandusky Paint Co., Sandusky, Ohio. To fill vacancies, McCleland Taylor, Capital Paint and Glass Co., Jackson, Miss., was elected to a two year term and Stephen L. Wolf, S. Wolf's Sons, New York, N.Y. was chosen for a one year term.

Resin Research Expands

In order to service the ever growing resin and plastic industry, Polymer Engineering and Development Corp., Newark, N. J., has been organized. The new organization is an adjunct to Resin Research Laboratories, Inc., also of Newark.

Polymer Engineering announces its intention to offer the complete service of pilot plant facilities, process development, and engineering design and construction to resin and polymer plants. Additionally, its services will include plant design and layout for resin and plastic fabrication.

CALENDAR OF EVENTS

Jan. 23-25, 1957. Association of American Soap and Glycerine Producers' Convention, Waldorf-Astoria Hotel, New York.

Jan. 28-31, 1957. Plant Maintenance Show, Public Auditorium, Cleveland, Ohio.

April 10-13, 1957. Twenty-first annual convention of the Southern Paint and Varnish Production Club, Soreno Hotel, St. Petersburg, Fla.

Production Club Meetings

Baltimore, 2nd Friday, Park Plaza Hotel.

Chicago, 1st Monday, Furniture Mart.

C.D.I.C., 2nd Monday.

Cincinnati — Oct., Dec., Mar., May, Hotel Alms.

Dayton — Nov., Feb., April, Suttmilers.

Indianapolis — Sept., Claypoll Hotel.

Columbus — Jan., June, Fort Haynes Hotel.

Cleveland, 3rd Friday, Harvey Restaurant.

Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.

Detroit, 4th Tuesday, Rachham Building.

Golden Gate, 3rd Monday, E. Jardin Restaurant, San Francisco.

Houston, 2nd Tuesday, Bill Williams Restaurant.

Kansas City, 2nd Thursday, Pickwick Hotel.

Los Angeles, 2nd Wednesday, Scully's Cafe.

Louisville, 3rd Wednesday, Seelbach Hotel.

New England, 3rd Thursday, University Club, Boston.

New York, 1st Thursday, Brass Rail, 100 Park Ave.

Northwestern, 1st Friday, St. Paul Town and Country Club.

Pacific Northwest, Annual Meetings Only.

Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.

Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.

Rocky Mountain, 2nd Wesnesday.

St. Louis, 3rd Tuesday, Kings-Way Hotel.

Southern, Annual Meetings Only.

Toronto, 3rd Monday, Oak Room, Union Station.

Western New York, 1st Monday 40-8 Club, Buffalo.

abstracts

The following are abstracts of the various papers read at the June 1956 meeting of the Koerperfarben und Anstrichstoffe (Pigments and Paint) Section of the German Chemical at Essen, Germany.

Problems in the Manufacture Of Isocyanate Lacquers
By E. Pflueger

The author first gave some introductory indications of the important position which the isocyanate poly-addition process (under the commercial name of Desmophene and Desmodur) now occupies in various markets.

As is known, the fundamental reaction is based on the reaction between a poly-oxy compound with a poly-isocyanate. Very resistant finish films are obtained from this reaction by the urethane linkage formation which takes place under normal temperature conditions. The noteworthy characteristics of the film obtained were discussed in detail. Indications were given of the control of various film characteristics by suitable combination of the starting materials. This manifold combination capacity of the various polyoxy compounds and of the isocyanates leads to the following. Associated with this it is possible to determine in advance to a considerable extent the various mechanical characteristics of the film, such as elongation, elasticity and hardness as well as the chemical resistance. Considerable attention was given in the paper to this aspect of these finishes.

Examples were given of the manner in which this control can be conducted. There was then discussed the development of the various Desmodur types which are employed for lacquer production and details were given of their physiological characteristics.

Recently it has been possible to develop a grade of isocyanate which is practically free from volatile isocyanates and which is particularly suitable for laquer production. The application technique of this new product corresponds to the characteristics of the known Desmodur TH 75% in ethyl acetate. The determination of small amounts of isocyanate present in the air of the working room were described in association with this.

For this purpose, a special apparatus has been developed, by which aid these amounts can be measured. The results of the measurements were shown by numerous curves and graphs. The maximum threshold concentration served as the theoretical comparison basis. For the new Desmodur types, the threshold concentration values are very favorable.

In the discussion, a question was raised regarding the application of these finishes in certain cases. A special case in question is the coating of copper vessels internally with the isocyanate lacquers. The vessels in use are exposed to the action of hot steam. It has been found that pore formation rapidly occurs and the film partly lifts. The main question at issue here is the bad adherence of these finishes to copper. This was first indicated by test lacquering in the laboratory. With the lacquering of the large copper vessel it was found that with a two coat application, the pore formation occurred in the base coating.

The trouble was ascribed to the fact that the finish was being overtaxed. A two-coat finish could hardly be expected to compensate out at the working

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temperature of the hot steam (120° C.) all the various demands imposed—expansion, temperature resistance etc. It was possible also that a certain amount of moisture had diffused into the film. This could not leave again and so led to blistering. If a false solvent admixture is chosen, this will also lead to such troubles, by retained solvent medium. For application, to a metal copper metal surface, the lacquer needs to be formulated so that it is very elastic. It was also considered that for such conditions, it is necessary to prepare the surface with a wash-primer and to withstand the hot-steam conditions, not less than a 6-8 coat application should be given.

It was considered that with the new Desmophene products, a wider field of application for the DD isocyanate lacquers had been opened up. This is particularly so with the more difficult application conditions. The discussion centered mainly on this question of the obtaining of a suitable lacquering finish to stand up to such extremely severe service conditions. It was considered that the synthesis of the unsaponifiable Desmophenes was a considerable step forward, but more important still, it was held was the obtaining of a pore-free lacquer coating, by the application of sufficient coatings. Regarding the total film thickness which should be obtained for severe working conditions of this nature, it was considered that a total thickness of 120 microns or more should be obtained by a multi-coat application. Sufficient attention is not given to this factor in practice.

As regards the hygeinic aspects of the DD lacquers and possible health dangers during application, it was stated that the new di-isocyanate type lacquers are practically danger-free. However, it is still advisable to observe and practice the precautions hithertoo taken with these finishes.

It was considered that it is probable that the ester linkage present might serve to impart a certain hydrophilic characteristic and the weakness of the saponifiability might be excluded. Against this, it was pointed out that from experience, it is known that pure water is more dangerous to the resistance of the finish than is weak lye.

Further to the question of the resistance of paint and lacquer finishes to severe working conditions, the statement was made that all air-drying finishes fail when exposed to the action of water above 70° C. including chlorinated rubber, Neoprene, epoxy resin and the DD laquers. It was considered that above 70° C. water diffuses into the finish film and leads to blistering. It was stated that a baked finish can be regarded as having five times the service life, under these severe working conditions, that an air dried finish system gives.

Aluminum Re-enforced Alkyd Finishes
By W. Koenig

The general rule holds good that for the drying of oil-containing filming agents, the film through-dries all the more rapidly and better, the slower the drying proceeds. This can be explained by the mechanism of the oil drying, which as an oxidative process, begins first at the boundary surface film-air. With increasing film thickness, the through-drying is more restricted.

The author then discussed the methods which have been applied, to improve the through-drying. Such methods are the admixture of various alkyds or the use of anti-oxidants or inhibitors respectively. With very full lacquering, these give only limited satisfaction. A better possibility is perhaps offered by the application of the metal-strengthened alkyd resins.

The author then discussed the most important lacquer-techniques characteristics of the aluminium-strengthened alkyd resins in comparison to the normal alkyd resins, in considerable detail. Considerable data was given on the various drying possibilities offered by the aluminized alkyd resins influenced by the addition of different driers. The author stated that with the same drying, these products showed considerably better through-drying characteristics than do normal alkyd resins. Different examples were given of the application of various drier conditions with cobalt- or cobalt-lead or cobalt-zirconium driers respectively and the

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drying procedure of these with the aluminized alkyd resins was discussed.

The specific through-drying capabilities of the aluminized alkyd resins, offer various advantages for practical working. The lacquers can be applied as a full finish, without surface disturbances occurring. Air-drying formulated lacquers can be dried up to 100° C. by means of accelerated heat-drying, with the maximum amount of driers.

Although water-swell absorption and water vapour permeability is somewhat higher with the aluminium-strengthened alkyd resins than with normal alkyd resins, this is not the whole story however. They show nevertheless, a considerably better behaviour when exposed to water and moisture than normal alkyd resins, so that their application is possible also for underwater coatings for boats and ships. The resistance towards alkalies is likewise considerably improved.

By means of viscosity-time curves, the storage stability of the aluminized alkyd resins was investigated, either alone, or in combination with other normal alkyd resins. The aluminized alkyd resins in themselves, show good storage stability. By admixture with other alkyd resins, the storage stability is relatively dependent on the type of the resin and on the combination ratios. Aluminized alkyd resins are characterized by good weathering resistance. They can be employed for various industrial and transport vehicle finishing, as high grade building construction finishes, for ship and aircraft painting, etc.

As regards whether the aluminized alkyds give perfectly clear finish films, this was stated to be the case. A query was raised as to whether the aluminium alcoholates in the film would later react further and through this, a tendency towards film embrittlement would be present. It was stated that such an embrittlement tendency had never yet been established. Further, that the aluminium-strengthened alkyd resins, in no case behave worse with weathering than do the normal products. On the contrary, it can be established that they are somewhat better in their mechanical behaviour.

From the swell-absorption investigations which have been carried out, a better adherence of the aluminium-strengthened alkyd resin films results. This characteristic stands in a certain relationship to the swell-absorption values measured. With water-storage tests, it was found that normal alkyd resins become detached from the test-coated plates, while the aluminized alkyd films do not. This loosening and detaching of the film from the base support does not always only start from the edge. The loosening and detachment can take place at different parts of the surface inside the edges. This holds good not only for pigmented films but also for clear laquer films.

The question also arose, as to whether in the case of the aluminium bronzes, which were formulated with a linseed oil alkyd as the filming medium, this conception of the aluminium strengthening could be applied. Also whether corresponding reactions, for example during storage or also with the film formation, could take place with such bronze pigmented lacquers. It was stated by the author, that this was not possible. The favorable behaviour obtained with the aluminium pigmented finishes could be ascribed solely to the effect of the pigmentation. The scale-like aluminium particles protected the filming medium from the effects of weathering influences.

The pigmentation employed and the precise nature of the driers employed was also discussed. Discussion was also given to comparative water-storage tests with phenol resin-wood oil combinations as ships finishes, based on normal alkyd resins. These comparative water-storage exposure tests served to show the low softening of the aluminized alkyd product, as compared with the normal alkyd resins. There was also found to be a much more rapid return to the original film condition, with the de-swell absorption with the aluminized resins. This was reflected in a much higher stability of the aluminized alkyd films under such conditions. Part of the superior behaviour obtained with the aluminized alkyd films, was ascribable to the fact that with normal alkyd resins, the same coating thicknesses could never be obtained such as were possible with the aluminized alkyds. This in itself was significant, because

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other things being equal, a given film thickness obtained with a one-coat application would be superior to that obtained with more than one coat application.

Some indication was also given in the discussion of further metal-modified alkyd resins, for example on a titanium basis.

Effect of R. H. on the Drying of Oil Paints

By H. P. Kaufmann

Reference was made to previous tests (Fette, Seifen, Anstrichmettel, vol. 58, p. 171 (1956), in which it was shown that with the drying of wood oil or alkyd resins, which contain conjugenic acids, an "optimum relative air humidity" is to be observed. This came also into appearance when drying with cobalt and lead, but to a lesser extent with admixtures of 3 or 4 metal naphthenates.

The drying was dependent on the nature of the lighting and in this connection, differences were found with the use of UV quartz lamp light and Solux lamp light. With the drying of oils there is to be observed not only a difference in the molecular enlargement of isolenic and conjuenic oils.

As has been shown by Kaufmann and co-workers, there are specific driers for both groups of oils (I—driers and K—driers). An example of a typical K—drier is the radical drier of the type of triphenylmethane. With refined conjuenic oils, normal metal driers do not allow an acceleration of the drying. Primarily here, in this case, they fulfill the task of removing anti-oxidants which are present.

The tests were continued with the use of mixtures of isolenic (linseed oil) and conjuenic oils (wood oil). With these tests, there was found to be a considerable acceleration of the drying as compared with the behaviour of the individual constituents. Here also, it was found that the air humidity and the choice of the drier were significant. The test results in tabular form, show this very clearly. The possibilities of the opposing influencing of the two oil types with the molecular enlargement in the presence of driers and moisture, were discussed in detail. A noteworthy difference also exists between raw and refined oils. With linseed oil and wood oil, the refining shows as an opposing influence as regards the drying tendency.

One of the astounding features of this investigation was the significant effect of the air humidity which emerged and the varying influence of this humidity with the use of various driers or varying light sources. It was shown graphically that there was a clear maxima of the drying in relationship to the air humidity but also to the lighting. The results of the investigation which were presented, served to give an interesting survey on the relations between the influencing factors on the oil drying. This served to show how complicated these processes are and how little we still know in general, on the filming processes of the oils. It is useful to note that these questions which in themselves represent a whole complex of special problems, are being studied in detail and investigations conducted under clearly defined conditions. It was confirmed by the authors that the numerous, often conflicting results obtained with the drying investigations on oils, often have their cause only in the lack of clear and defined test conditions.

The question was asked as to the determination of the drying and as to any surface disturbances by wrinkle formation. It was stated that the drying was determined by the sand method. Disturbances by wrinkle formation only occurred with a ratio 12: of the mixture linseed oil—wood oil. Discrepancies which occurred between the good results of laboratory testing and bad results with practical application, were also discussed. This can be explained by the influence of varying air humidities. The tests were conducted in air-conditioned cabinets. Although in individual cases this may not correspond precisely to practice, however with an investigation of this nature, clear and precise test conditions must be maintained. This renders a clearcut starting point from which to evaluate the results.

Condensation Products as Film Formers

By M. Kuehn

A detailed study of the processes occurring with the rusting of iron and steel led to the postulation that the prevention of the rust formation occurred by the passivation of the iron

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surface by certain acids. These acids form insoluble iron salts of heteropoly-acids with the iron ions which occur with the primary process of the rust formation. It was found that in an alkaline medium, absolutely no rust formation can occur. This provided the pointer for future development research, to produce film-forming substances with an alkaline reaction.

Lacquer resins in normal use are high-molecular neutral or acid organic compounds. By heating with inorganic bases such as lime or zinc oxide, or by esterization with glycerine or pentaerythrite, the acid resins can be more or less completely neutralized. The use of high-molecular organic substances with outstanding basic characteristics as film-forming laquer resins, up to now has not been a practical feasibility.

This only became feasible with the investigation of. the reaction possibilities of the epoxy resins. With these, by cold hardening with aliphatic diamines, basic reaction products with secondary amino groups were obtained. These were outstanding by their good adhesion to metals and their rust- protecting action.

As far back as 1930, the author with another objective, had prepared basic esters and amides from unsaturated fatty acids as for example, chaulmoogra acid, oleci acid and linoleic fatty acids. According to our present knowledge however, such substances can however, form no films. A film formation from basic esters or amides of the unsaturated fatty acids of drying oils is only to be expected, if a three dimensional polymerization is possible during the drying by the use of at least three-functional alcohols with basic groups or corresponding reactive polyamines. This constructional principle was at first, not taken up again.

For the synthesis of suitable high molecular organic substances with basic characteristics for film forming applications, the three types of reaction for the formation of high molecular substances, enter into consideration. These are polycondensation, polymerization and poly-addition. To obtain high molecular basic substances formed by polycondensation, recourse may be made to an old observation made in 1911. This was that aromatic biguanides can be condensed by formaldehyde to high molecular, strongly basic substances.

While the neutralization of acid resins by lime or zinc oxide always remains incomplete, neutralization with high molecular organic bases allows the use of an excess of the basic salt component. The high molecular basic organic salts thus obtained are soluble in mixtures of aromatics with polar solvents, preferably butyl alcohol. The films which are obtained by evaporation, are however, too brittle for any lacquer application, and swell too strongly by water-absorption.

The production of usable films however, became possible by the mixed condensation of the biguanide bases with plasticising non-basic condensable substances, as for example, ketones and alkylized phenols by means of formaldehyde. The choice and preparation of further substances suitable for mixed condensation is the object of further detailed research at the moment.

The mono-condensation product of phenyl biguanide and formaldehyde was only compatible with urea resins and low molecular epoxy resins. However, the basic mixed condensation products which contained either alkylized phenols or ketones as the mixed components and similarly both the two non-basic substances, showed themselves to be compatible with nitrocellulose, alkyd resins and phenol resins. Only a limited compatibility could be achieved with chlorinated rubber and cyclicized rubber. The compatibility can be raised by partial neutralization of the high-molecular bases with resin acids, linseed oil fatty acids and by fatty acids and dicarbonyl acids substituted with phosphonic acid and arsonic acid groups. The characteristics of the individual mixed condensates were presented in a comprehensive table.

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which were exposed for many months to the aggressive air of the laboratory fume hood, gave an absolutely certain rust-protective action, even at those places where the film had been damaged by scratching.

Aliphatic diamines and polyamines were incorporated in the condensation rests, as basic mixed condensation components, in place of and together with the biguanides. Further basic resins were prepared according to the constructional principle of polycondensation by the amidization of dicarbonyl acid esters with triamines. In addition to two primary amino groups capable of reaction, they contained in addition a secondary or tertiary amino group. By the Mannich condensation with ketones and phenols, according to this a further molecular enlargement could be undertaken by polymerization, at the secondary amino group. The basic resins obtained are variable to a wide extent in their characteristics, by the choice of the components used. From the basic resins so prepared, usable basic films were prepared by cooking with an amount of colophony insufficient for neutralization, in linseed oil.

Phthalic acid and adipinic acid were used as the dicarbonyl acids for the synthesis of these basic polyamides. Maleic acid was co-condensed together as an unsaturated dicarbonyl acid. This was so as to incorporate the unsaturated, basic polyamides so formed as mixed polymerization components into unsaturated polyester and polyamide resins respectively.

Tests were further conducted, to use allyl bases as polymerization components. It was possible to prepare tetra-allyl-ethylene diamine and penta-allyl diethylenetriamine by alkydizing with allyl chloride, with a good yield. It was not found possible however, under the conditions of the polymerization of the unsaturated polyesters, to in-polymerize these basic substances into the macromolecule.

A quite new body class of the basic polymamides was obtained by the amidization of aliphatic polyamines with the esters of organic phosphonic acids and by mono- and dicarbonyl acids substituted with phosphonic acid groups. The phosphonic acids are to be regarded as dibasic acids. Phosphonic acid substituted- mono- and dicarbonyl acids most accordingly as 3 and 4 basic acids, form basic polyamides polymerized to a considerable extent. The carrying out of this research is at present in progress.

According to the synthesis principle of poly-addition, basic high molecular polyurethanes can be prepared by the known working methods by the use of glycols which contain tertiary amine groups. The preparation of the diamine which has already been mentioned as a condensation component offers certain possibilities. In addition to two primary amino groups capable of reaction, the diamine contains still a tertiary amino group. It offers the possibility to obtain basic di-isocyanates from these substances, as reaction components.

With the cold hardening epoxy resins, the poly-addition occurs at the two primary amino-groups of the aliphatic diamine, at the epoxy groups. By mixed condensation of mono- and difunctional biguanides with aliphatic diamines, by means of formaldehyde, it was possible to obtain higher molecular basic substances, soluble in water and alcohol. Accordingly also, a way is opened up in the field of the epoxy resins, by which their scope is widened considerably. The epoxy macromolecules have already been proven as outstanding film formers. It is now possible from the above, to incorporate additionally, higher molecular, strongly basic units. Research investigations on the laquer-technicque characteristics of these substances is in progress at the moment.

The more or less pronounced water-sensitivity which has been observed with these basic substances, would not act as a disturbing influence on the usability of these basic film-formers as intermediate coatings for rust-protective coatings. It appears even of advantage for the termination of ionic reactions. It would appear even necessary and desirable for the following reason. With damage to the top cover coating, or with the unavoidable pore formation of the cover coating, traces of acid which penetrate into the finish from the acid industrial air, are trapped in

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the basic intermediate coating, before they can penetrate through to the iron surface. If they were not trapped, they could induce corrosion at the steel surface.

The normal wash primer or the alkyd resins with free phosphonic acid groups developed in the author's own researches can be used as a passivating adhesion primer base. With this, zinc chromate or chromates and molybdates of the biguanide condensation bases precipitated on vermiculite as carrier, were tested as pigments for strengthening.

The bad compatibility of the basic film-formers which have been observed up to now, with chlorinated rubber and with cyclicized rubber, prevents any lifting of the basic intermediate coating with the application of these substances as film formers for the protecting cover coating, with the planning of rust-protective coatings of this type.

Obviously, investigations were also made, to raise still further the basic characteristics of the intermediate coating by the use of basic organic materials as supporting and densifying pigments. Through this also, to ensure to a certain extent, a supply of basic reaction influences. Precipitations of high molecular bases on vermiculite as a carrier, were prepared for this purpose, and tested. No definite conclusive statement can yet be made on the practical behaviour of such a finish formulation because of the short observation time, which has as yet elapsed.

The question was asked, as to whether numerical data is available regarding the degree of basicity of these new finish products. It was stated that this is available at present, only for the phenyl biguanide. The development of these new products is at present still in the laboratory stage and practical testing under practical conditions has still to be conducted.

Mold Growth on Paints

By K. Meier and H. Schmidt

In this research, mold growth was investigated from the viewpoint of finish technology, based on the mycological fundamentals. In particular, an endeavour was made to ascertain as to how far a native fungi resistance is incorporated in the filming mediums. This data appeared valuable, because with stronger climatic stressings, (tropical climates), anti-fungidal addition agents often showed no permanent effect.

To follow the mold growth, the through-dried film was inoculated with a fungi growth spot and the time-behaviour of the radial growth of the mold spot was followed in a warm, damp chamber. In this way there were observed growth speeds of a few microns up to 2,500 microns per day. The investigations were conducted on 16 types of fungi and 23 various types of filming mediums.

The food-intake of the fungi cells consists in the entry of dissolved substances in the protoplasm of the fungi cell which is surrounded with a skin. With this procedure, the protoplasmic skin regulates the type and amount of the foodstuff being absorbed as well as the expulsion of ferments and material-exchange products. As macromolecules are not able to pass through the protoplasmic skin, only water-insoluble hydrolytically and fermentatively broken-down constituents of the filming medium, enter into question as foodstuffs. For foodstuffs there are required: Oxygen, Carbon, Nitrogen, Phosphorus, Potassium, Magnesium as well as trace elements (iron, manganese, copper). As the protoplasmic skin restricts the diffusion speed of organic substances with carboxyl and amino groups, neutral compounds serve dominantly for the nourishment of the mold.

The fungi resistance of a filming medium against the different types of

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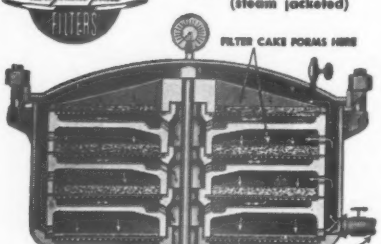

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molds, is very variable. Thus for example, no growth was shown by *Aspergillus niger* on polyvinyl acetate, coumarone resin and Linoxyn. However, with phenol and amine resins, nitrocellulose and chlorinated rubber, growth was observed. From this selective behaviour of the fungi, for testing technique the important conclusion follows that a testing for mold resistance must always be conducted with various cultures or with a mixture of cultures.

Mechanical film characteristics, such as hardness are of considerably less significance for the growth than the chemical composition of the film. High acid numbers and fungi resistance of the filming medium stand in a definite relationship to one another. This also holds good too, where acid constituents are formed as a result of hydrolytic splitting (polyvinyl acetate). The pH optimums for the growth, in general are located near to the neutral point in a weakly acid range.

Of the external influences, high air humidity and moderate warmth favor the mold growth. With this, each type of fungus possesses a certain optimum. There is also an influence exercised by the light, by which ultra-violet and infra-red radiation act restrictively on the growth speed. This means that a damaging effect is given by direct sunlight radiation. A domestication of a fungus from generation to generation on a definite filming agent could not be observed.

Besides the optimums of the external conditions, the fungi likewise possess an optimum for the foodstuff concentration. The deviation from the concentration optimum likewise is sufficient to signify a damaging effect for the fungus. From the very large differences in these optimums, it follows as to whether the individual substances are foodstuffs or toxic substances. The solubility in water likewise plays a role. The fact that a toxic substance such as the phenol constituent of the phenol resins, can serve as a foodstuff can be seen from the mold growth on these resins. It could be shown that a growth favoring effect occurred with a 0.05% aqueous formaldehyde solution. With a concentration of this solution above 0.5%, a damaging effect to the growth occurred.

The effect of toxic substances is dependent on their concentration in the coating medium. Investigations on the restricting effect of drier substances (metal naphthenates) showed that the normal drier metals used are able to act restrictively on the mold growth. It was found that of the compounds investigated, silver naphthenate exerted the strongest influence.

The discussion was concerned mainly with the effect of pigments on the mold growth prevention on paint films. The effect of the pigmentation had not been investigated with the present research, but some additional information on this point from other investigations was proffered. Extensive research by Prof d' Ans had served to establish that some fungi possess an astounding resistance against pigments. This is in actual fact the case also, even against those pigments with which one would anticipate a strong toxicity, for example, Schweinfurter Green. The fungi grow around the pigment, so to speak. Lead compounds are hardly poisonous at all against the fungi. Zinc compounds also are only toxic to a very low extent. Copper hydroxide is relatively poisonous. The problem of finding poisonous substances for fungi consists in the fact that these substances must be simultaneously oil soluble and water soluble. For these reasons it is a difficult matter to find suitable products.

Regarding the effect of mixtures of filming mediums the following can be said. It would be uncertain to judge the effectiveness of the filming medium mixture from the effectiveness of the mixture constituents. An experimental testing must be undertaken in every case.

Concerning the fungus types tested, it was stated that the fungus A tested had been found to be particularly suitable. This had been found to behave the most aggressively. It had not been possible to identify it; it had been obtained from a painted wooden garden fence in Brandenburg. Although not identified, this was a type of fungus which was widely distributed.

The Action of Plasticizers

By E. Jenckel

The author dealt first with the general questions of plasticization, which are to-day of particular interest to every paint technician. There was first discussed the characteristic properties of high molecular substances. From the physico-chemical viewpoint these may be characterized as super-cooled melts. They are present in a vitreous condition. The transition from this into the crystalline condition is characterized by a sudden change of properties.

Details were given of the freezing temperature of the glassy solidified substances and the significance of this on the mechanical behaviour. Special attention was subsequently given to the experimental methods for the determination of the freezing temperature. The determination can result from the volumes, the refractice index, from the electrical resistance and from the oscillatory-damping.

The author then passed to discuss the freezing temperature of chemically unit

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substances and of plasticized substances. The plasticized resins, prepared in solution, were then dealt with. Further discourse was then made of incompatibility phenomena and experimental methods for determining the solubility curve from the refractive index and from the oscillatory-damping.

The transition from the vitreous to the crystalline condition can be followed by the determination of the freezing temperature. This determination can be undertaken with the Dilatometer, by the measurement of the dielectric constants and of the thermal contents. As the transition in the glassy condition is also characterized on cooling by a rise in viscosity, this can also serve as a basis for the measurement of the flow capacity. The latter can be carried out with the aid of the damping of torsion oscillations.

Elasticity Studies of Paint Films
By H. Wapler

Details were given in the paper of the results of a large investigational test series. Eleven test methods in current use for the testing of the elastic behaviour of paint films by their deformation, were compared with one another under the correct test conditions. Various types of filming mediums were used for the investigations, in the form of non-pigmented and pigmented laquers. This was to serve to establish as to how far the type of the filming medium influences the results with the various testing methods.

The investigation results made possible the appraisal of the various testing methods as regards the field of their application and the nature of the stressings imposed with the testing. The results showed also as to how far conclusions can be drawn from a certain testing method on the practical elasticity behaviour. With this, it was found in particular that fundamental differences exist between the elastic behaviour with slow (static) stressing and with rapid (dynamic) stressing. This is particularly clearly demonstrated from the speed-relationship of the stress-elongation diagrams.

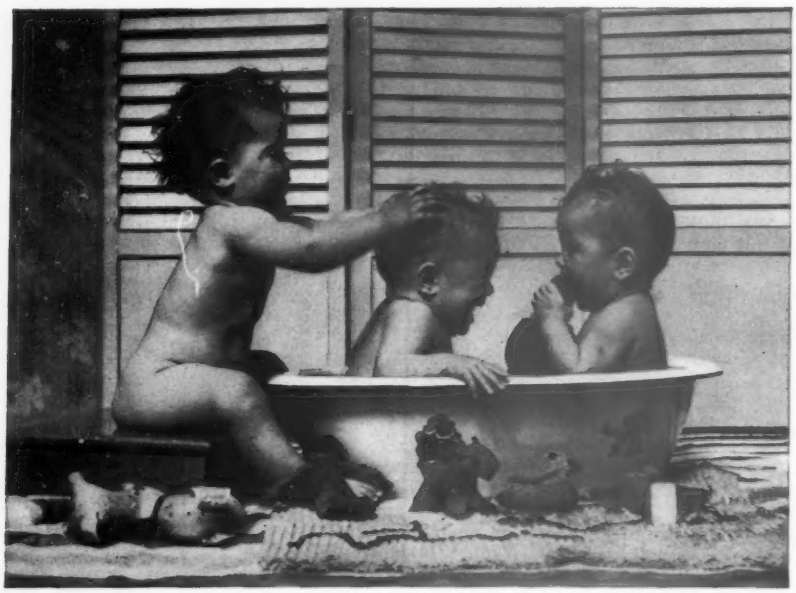
The influence of the test conditions such as coating thickness, temperature, air humidity, and testing speed, with the comprehensive testing was shown to be a very important factor and quite variable for the different types of filming agents. The practical application possibilities of the various test apparatus were discussed on the basis of the results obtained.

In the discussion, details were asked as to the preparation of the test paint film and in what manner the loosened film had been tested for its swell-absorption. The preparation of the test film involved removal from the glass plate or from the zinc plate by means of mercury. The free films had also been tested. It had been found that at the beginning of the swell-absorption the films were more sensitive towards rupture stressing; they become more elastic only later.

Another method was described for the preparation of free test films which had been developed because a deformation of the film can occur when loosening from glass plates or steel sheets. This can lead to a falsification of the test results as a consequence. A O. 1 mm. thick aluminium foil is used with the new method, from which the paint film is removed by means of a 2% mercury chloride solution in alcohol. Only small deviations of the test results were obtained with 50 to 60 tests.

It was considered by the author that an elongation of the film when removing this from the sub-surface, is unavoidable. In the above test work described however, all possibilities were applied, to hold the defects which arise at a minimum. It was asked also if some of the testings could be applied to a very elastic range so that they would be suitable for oils. No tests have yet been applied in this direction however.

The coiling test was mentioned, which is used for testing of wire laquerings. It frequently happens that with the pre-testing a laquer shows no crack-formation. Later however with the application of the laquer in the electrolytic fluid, crack formation occurs. From this it follows that a quite different stressing occurs in the electrolytic fluid. For the newly developed Erichsen apparatus Model 225, the requirement is present accordingly to dispense with the measurement of the crack



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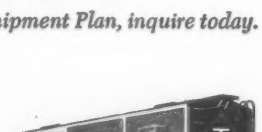


formation by the electrical way. With this also at present, the formation of cracks is measured in the electrolytic fluid.

It was also mentioned that the Erichsen apparatus can easily give an after-tearing after the testing. This defect was to a large extent obviated by the use of a depth-testing apparatus which was developed, employing a 5 mm. ball, as here the influence of the adhesion is considerably smaller.

The adhesion characteristics of the film enter into this type of testing quite considerably. A change in the adhesion can occur through the swell-absorption and this can be very varied, with different films. It was not considered satisfactory to conduct elongation measurements with simultaneous swell-absorption influence: it is better to replace such overlapping measurements by the measurement of a single characteristic. The electrolytic method should be dispensed with, and optical methods employed.

It was fairly generally agreed, that the optical investigation method gives far better reproducible values than the measurement of elongation characteristics by the electrolytic cell. With the Erichsen testing method, the adhesion must be taken into consideration. With rapid stressing, the adhesion shows a behaviour which is different than with slow stressing.

Electron Microscope Studies Of Paint Films
By E. Fischer

Initially, the author discussed the investigation technique for the preparation of electron-microscopic specimens of paint and lacquer finish film surfaces. The method of surface off-prints was dealt with in full detail as also was the vacuum vapour-phase deposition method. By means of numerous, exceptionally good specimens, the author demonstrated the influence of the working conditions, flow and gloss-promoting additions.

From the electron microscopic photographs obtained, indication could be obtained of the formation of the surface structure of the films. This is particularly the case in conjunction with the super-microscopic investigation of the degree of dispersion.

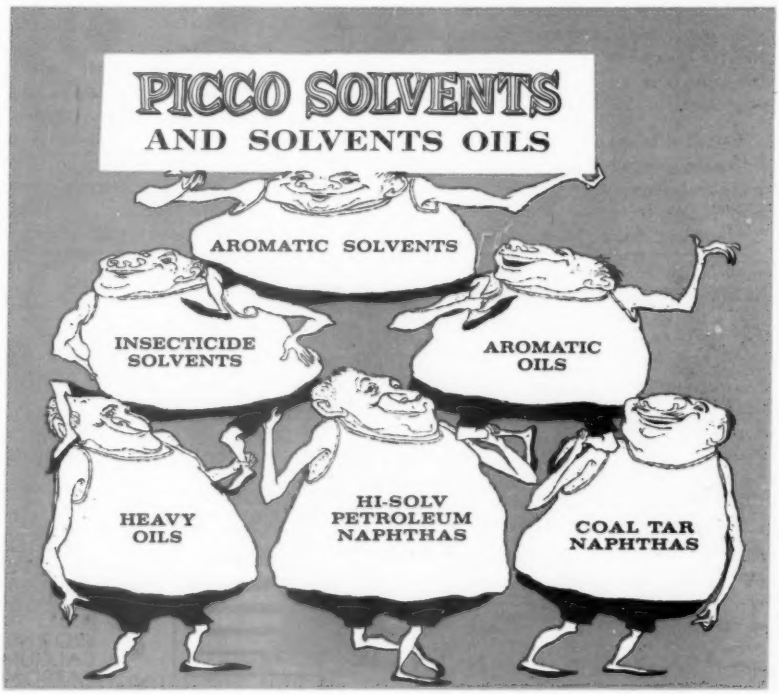
The author dealt in particular detail with the application of electron microscopic methods with weathering tests. In this way, it is possible to follow the stages of the film destruction; these stages have not yet been established by light-optical investigations. The influence of swell absorption phenomena and of ultra-violet radiation were also investigated in this manner.

The results of the comparative electron microscopic investigations of natural and artificial weathering, were particularly interesting. With this, paint technicians have now available a new type of investigating technique. In certain cases this new technique can offer much towards the clarification of unsolved problems in paint technology. Whoever has been concerned with the carrying-out of electron-microscopic investigations on paint and lacquer films knows how difficult it is with the technique of the examination specimens and the evaluation of the examinational samples. This is not merely a question of apparative layout but often a question of the skill and patience of the investigators. Of particular importance in this connection was the sober and clear method of consideration of the person carrying out this investigation. The specimens and results were not only presented with theoretical deduction and conclusions, but offered to discussion with a critical consideration of the investigational results.

For preparing the surface offset print specimens, which consist of a thin coating capable of being penetrated by electrons, specials means are required to avoid surface changes.

It was mentioned that the direction of the light impingement is of significance with the electron microscopic evaluations. Regarding the film thickness and as to whether with very soft, linseed oil films, damage can occur with the preparation of the test specimens, the following was said. The film thickness amounted to 80 microns. As regards possible damage, the conditions with the SiO vapour deposition method applied were very gentle. No investigations were conducted as yet, on films of a basis of unsaturated polyester, nor on nitrocellulose or polished films.

The question of false findings and



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conclusions arising from external contamination of the film during examination was raised. For example, the question of dust contamination is always present as a possible danger to obtaining false findings. The dust particles are always present and these naturally, always show up as prominences on the test specimen. However, it was stated that false results from this cause, can be avoided with the electron microscopic examination. The question was raised also, as to the possibility of the influencing of the film surface by the high vacuum used with the vapour deposition process, for obtaining the offset examination specimens of the film.

Fire-Resistant Paints
By K. Ulbrich

The author first discussed in detail the possibilities and the significance of chemical fire-protective measures and dealt with the mode of action and the composition of the normal fire protective mediums. Indications for the preparation of pre-protective mediums follow from the observation of the combustion processes.

Detailed discussion was given to the differences between fire-protective mediums and fire-protective finishes and the application-technique limits which exist between these two types were dealt with. Developing this theme, investigation was made as to how far a normal finish coating serves to increase the combustibility of the wood. It was established that contrary to the often-held opinion, this is not always the case absolutely.

Detailed consideration was then given to the main group of the various fire-protective paint finishes. These can be sub-divided into two main groups which are the insulating-coating-forming, fire-restricting finishes and the paint finishes which are inflammable with difficulty and which do not spread the flames.

The raw materials used for the preparation of these fire-protective finishes were then discussed and the suitability of the various filming agents for the formulation of finishes of this type. Pigments and filling materials have a special influence on the quality and degree of efficiency of fire-protective finishes.

With those finishes which form fire-insulating coatings which were regarded by the author as particularly important, the mode of action of new filling material developments were discussed in full detail. Various examples were demonstrated of the effects which can be achieved with systems of this type.

By means of the materials investigated and of the problems discussed, a survey of the present position of technical development in the field of the fire-resistant paint finishes was provided. Indications were given of the significance of the connection between the finish technician and the fire-protective technician.

No really satisfactory test is available for the establishment of the fire protective action of a finish of this class. A method has been applied for the author's own tests, with which small fireplaces of board were built and the fire-protective action of the paint finish applied to the boards, was observed after ignition and measured.

With modern fire-protective paints, special significance attaches to the employment of addition agents which exude fire-damping vapours. Good results have been achieved in this direction. However, it needs to be mentioned that in spite of this, no fire-protective coating is available which impedes full combustion and none is possible.

The test methods with the radiation apparatus were discussed. This was developed by Dr. Schuetz and has been described in the technical literature. In answer to a question, it was stated that the thickness of the paint coating should amount to 120-150 microns to give the required fire-protective effect. For further progress with fire-protective paint finishes, it is an urgent necessity to find a really satisfactory test method.

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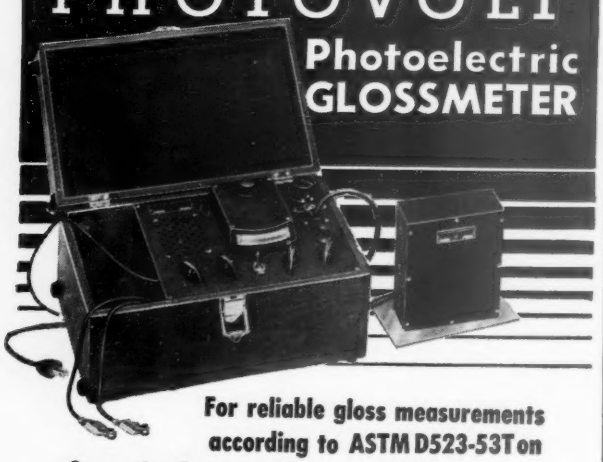

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The importance of testing with radiant heat was stressed and the opinion was advanced that the Schuetz test apparatus does not provide what can be regarded as an ideal method. A great many test methods have been proposed and the matter is somewhat complicated. By means of the measured values obtained, the author has wished to demonstrate that individual test methods can only be applied for a certain type of fire-protective coatings. As regards the Schuetz test apparatus, it was considered that for example, here also it is necessary to be ready to compromise. This is because for example, at the beginning of the testing, there is generally a small flaming through the effect of the radiant heat on the finish films. This was governed by the organic filming medium components always present in a lacquer and retained solvent medium residues. It was stressed that it was important to obtain a certain unification with the test methods employed; this was particularly desirable in the case of international shipping regulations. The important question of the exudation of poisonous gases from the finish, was raised. It was necessary to investigate to what extent during combustion, the components of the fire-protective paint finishes gave rise to the formation of poisonous gases such as phosgene with the chlorinated film-formers. In the case of serious fires, these gases could be of danger to the firemen.

Finishing Problems With Plywood

By C. Boller

Lacquer cracks obtained when lacquer finishing wood, particularly with veneers and plywood, in no way signify that the laquer used was unsuitable. The causes for these troubles can lie must as well with the wood as with the application methods.

The cause of cracking defects are extremely variable in the case of wood. For example, in the case of covering veneers the wood can be so coarsely porous that the hollow spaces have become filled with moisture during the gluing. The veneer used can also have been too thin and has accordingly become too much impregnated with glue. As a consequence, the glue has partly penetrated through right up to the wood top surface. It has then hardened out there so that the subsequently applied lacquering has no longer found sufficient keying possibilities.

Defects arising from the processing and the application of the finish mostly arise if the individual working stages have been undertaken in too rapid a sequence, without sufficient drying time being allowed between the stages.

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Or else the composite lacquer finish system possesses too low an elasticity.

Under such processing conditions, lacquers will frequently crack. Under other and more suitable and correct working conditions the same lacquers would provide good and durable lacquered products. These defects were illustrated by numerous micro-photographs, some of them colored, their originating causes being individually shown and discussed.

In the discussion it was stated that with wood lacquer finishing of this type, difficulties often arose because a false plywood base surface had been used. It was stated that the maximum coating thickness with wood lacquer finishing of this type, should amount to 150-200 microns. In practice, with polyester lacquering, different figures were recommended.

Determination of Aromatics In Hydrocarbon Solvents

By M. Keuhn

Aliphatic hydrocarbons provide the cheapest solvent for the lacquer industry. By virtue of its low health hazard dangers and its flash point which is located above 21° C. it has many application possibilities as a lacquer solvent. It consists almost exclusively of saturated aliphatic hydrocarbons. It is important to the lacquer producer to consider precisely the solvent characteristics of this material.

According to the country of origin of the crude petroleum, from which the hydrocarbon fraction is produced, a more or less high content of aromatic hydrocarbons can however be present in it.

While in recent years, hydrogenation cracking has been applied to an increasing extent for the production of volatile gas fuels, to be able to cover the large requirement in motor fuels, simultaneously also the reforming process has been introduced. This has been necessary to adjust the knock-stability of the motor fuel to the higher compression values used. Because of these modern working processes in petroleum refining, aromatic hydrocarbons are formed in the spirit from the aliphatic hydrocarbons by dehydrogenation reactions.

The fraction which is separated out for solvent use from the gas so processed can accordingly contain aromatic constituents to an increasing extent. To the lacquer producer, this content of aromatics would seem desirable on account of the better solvent capacity of these constituents. It is however known, that the aromatic hydrocarbons, particularly benzene itself, have a much stronger toxic action than the aliphatic hydrocarbons. By admixture of aromatic hydrocarbons to white spirit or solvent naphtha, quite easily therefore the threshold concentration of the aromatic portion could become exceeded, by addition to the aromatic portion previously present.

The working out of a determination method for the aromatics, which would be as accurate as possible and which could be conducted with the minimum expenditure in time and apparatus, appeared accordingly desirable. This was because the existing known test methods leave something to be desired. The newly developed method is based on the reaction of the aromatic hydrocarbons with chlor-sulfonic acid. The sulfonic acid chlorides are formed with this at room temperature from the aromatic hydrocarbons, with the simultaneous freeing of water. This water reacts with excess chlorsulfonic acid, by which hydrogen chloride is formed. Both reactions run quantitatively. The method of working consists in the fact that the hydrogen chloride is absorbed in water and the hydrochloric acid which is formed is determined by titration.

A detailed description of the apparatus used was given and of the method of working. For the determination there is taken 25 cc. of the hydrocarbon solvent and 8 cc. of chlorsulfonic acid. The new method of working provides more accurate results than with the test methods used up to now.

A further newly developed test method is based on the sulfonation of the aromatic portion with pure sulfuric acid. The content of olefines can also be ascertained with these methods. With this method of working, about 40 cc. of the aliphatic hydrocarbon are heated for half an hour with 15 to 20 cc. of sulfuric acid. The dark colored solution is poured into water. The content of free sulfuric acid can be determined by precipitation as barium sulfate or as benzidine sulfate, in a measured portion. The rest of the sulfuric acid which is not found, is present as sulfonic acid.

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In the cases where the olefines are to be determined, the acid sulfuric ester which is formed, is saponified by boiling, on a separate sample. The portion of olefines can be calculated from the difference of the sulfate precipitation. This method of working requires more time than the chlorsulfonic acid method. It does give however, more accurate results.

Hiding Power Measurements

By W. Garmsen

By covering power is understood the capacity of a dry lacquer paint film to render invisible to the eye in daylight, the texture, color and brightness contrast of a sub-surface on which it is lying. The covering power is based on one hand on the refractive and reflective processes. These depend on the difference of the refractive indices of the filming medium and the pigments. On the other hand, it depends on the light absorption, dominantly through the pigments. Covering power and transparency are complementary conceptions with the same number of light passes through the coating investigated. It is accordingly equivalent, whether one or the other is used for the measurement.

The covering power does not increase uniformly with the coating thickness but with this it follows a logarithmic relationship. This relationship can be deduced theoretically from the Fechner psycophysical fundamental law and has been confirmed experimentally by research. With the covering power measurements by means of painted pyramides, this fact was taken into consideration so that it was not sought to obtain the point of the same transparency on a pyramid and on a test plate, with uniform, incomplete covering stages (about 1/3rd). This measuring method is easily carried out and gives good reproducible values.

Test series measurements were carried out on lacquer paints which were only different in the content of the pigment being investigated. With these tests it was found that the covering power is not proportional to the pigment content. The transparency falls with rising pigment content according to a hyperbolical relationship of the general form:

$$f(x) = \frac{c}{x} - \frac{c}{100}$$

The "transparency constant" C increases between 100 and 20,000 for the normal pigment values. It can be employed for the characterization of the covering power behaviour of pigments.

From the mathematical consideration of the function given it follows that the influence of the pigment content enters in a multiple manner in the covering power. Also that the anomaly of its growth must occur particularly with the very powerful covering pigments. This can be confirmed experimentally.

Measurements on pigment admixtures showed that the covering power characteristics behaved in an additive manner all the less, the smaller the transparency constant is. Important indications are obtained from this for the preparation of pigment mixtures with optimum covering power-cost ratio.

Progress in Paint Testing

By O. Merz

In a critical survey, the author occupied himself with a consideration of various testing processes. In the beginning he established that with the application of testing apparatus, the question must always be kept prominently in the foreground as to what characteristics are being actually ascertained.

Processes are of special interest for practice which can be applied both in the laboratory as well as in practice, on the object. There were considered first the various problems of the coating sub-surface. There was dealt with in individual detail the rolling skin on steel, the moisture determination of wood and defect possibilities when painting brickwork.

The various test processes were then discussed, which are significant for the processing of a paint and lacquer. There were considered viscosity and spread measurements, drying time determinations as well as the measurement

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of the coating thickness, and of the brilliancy.

Measuring curves were shown by means of examples for the brilliancy measurements which were obtained by comparative measurements with various test apparatus and which in part, showed considerable deviations. The determination of the hardness of finish films was discussed in detail. This is a characteristic which up to now, has not been clarified very clearly. A need existed for the creation of an apparatus for the hardness measurement which is applicable also in practice i.e. on the object.

With the application of the various hardness testers, one must be clear always on the application technique and know, which value is being evaluated.

Considering the cold check test, it was stated that this also can be improved; the moisture resistance test was then considered. Apart from only a few methods and apparatus, test methods in general for paints and lacquers were characterized by considerable wants and the testing technique is influenced by this position. It is accordingly a task of the future to work further intensively towards the improvement of the test methods so as to create satisfactory bases for the examination and the comparison of the properties and behaviour of paints and varnishes.

The continually rising requirements imposed on paints in practice will lead, not to fundamentally new test processes, but to the refinement of existing test processes. It is considered that certain defects in lacquer testing have their origin in the fact that the development of physical paint and lacquer testing processes should be outside the hands of the paint chemist. The physicist should be called in for this purpose.

•

Kinetic and Sabo Combine

Kinetic Dispersion Corp. has acquired the manufacturing assets of the Sabo Machine and Tool Works of Buffalo, N.Y., according to Charles B. Kew, Kinetic Corporation president. Under the new setup, Gaze Sabo, president of Sabo Machine and Tool Works, will have complete charge of all manufacturing facilities of the combined manufacturing group.

Announcement has also been made of the beginning of an addition of 800 square feet to the Research and Development Laboratory at Kinetic Corporation's plant in Buffalo. This supplements an additional 1200 square foot building for housing new office facilities, which was completed only recently.

Dewey and Almy Builds Lab

Construction of a new $500,000 pilot laboratory has been begun by the Dewey and Almy Chemical Co., Division of W. R. Grace & Co. The new laboratory will house equipment and facilities for the storage, distillation and purification of monomers as well as coagulation and drying facilities.

According to president George Blackwood, the new laboratory will quadruple the area Dewey and Almy presently has devoted to piloting operations. Reactor equipment will range from quart size to 300-gallon capacity, both in glass-lined and stainless steel equipment. Facilities will also be provided for members of the company's central research staff to carry out special tests on runs under investigation.

The new laboratory is expected to be in operation by February, 1957.

•

Stresen-Reuter Names Rep

Fred'k A. Stresen-Reuter, Inc., Bensenville, Ill., manufacturer of synthetic resins and oils for the paint industry, has named C. D. Sampson as its sales representative in the area of Cincinnati, Ohio.

According to the company, Mr. Sampson is well-known in the paint and printing ink fields in his area. He will maintain a permanent office in Cincinnati.

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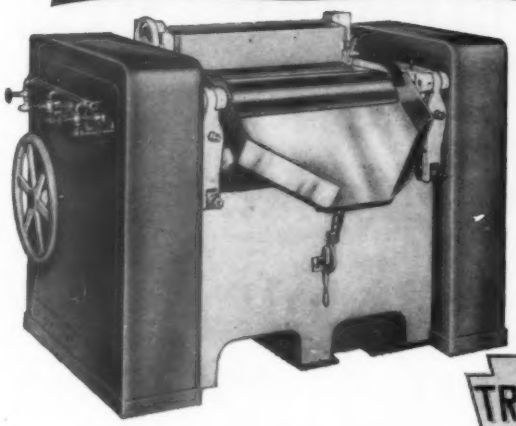

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TECHNICAL Bulletins

STATISTICAL DESIGN

Navy-sponsored lectures on the philosophy and practical use of statistics in research and design have been published in a 102-page volume and made available to the public through the Office of Technical Services, U. S. Department of Commerce.

The lectures were presented by civilian statisticians during a colloquium conducted at the Naval Ordnance Laboratory in 1954. They contain a series of viewpoints useful to the engineer or scientist concerned with designing experiments and evaluating the significance of the data.

Booklet PB 121181, "Collection of Papers Presented at the Colloquium in Statistical Design of Laboratory Experiments," may be ordered for $2.75 from the Office of Technical Services, U. S. Department of Commerce, Dept. PVP, Washington 25, D.C.

WET GROUND MICA

Studies on the influence of wet ground mica in polyvinyl acetate latex paints are the subject of Technical Bulletin No. 27 of the Wet Ground Mica Association, Inc., Dept. PVP, 420 Lexington Ave., New York, N. Y.

The studies measured the effects of systematically increasing the mica content in the paints, in regard to viscosity, washability, reflectance, and Weather-Ometer exposure.

INDUSTRIAL CHEMICALS

A new four-page bulletin summarizes physical properties and applications of products manufactured by Air Reduction Chemical Co., a division of Air Reduction Co., Inc. These products include vinyl monomers; acetylenic alcohols, glycols and hydrocarbons; ditertiary glycols; and non-ionic surface active agents.

Copies of bulletin may be obtained from Air Reduction Chemical Co., Dept. PVP, 150 E. 42 St., New York 17, N.Y.

POLYSTYRENE PRODUCTION

The Technical Service Bulletin of the Chemical Division of Koppers Company, Inc. provides background information on the history and development of commercial polystyrene production in its August, 1956 issue. Entitled "'Secrets' of Commercial Polystyrene Production," the bulletin also outlines some of the problems encountered, and summarizes the requirements for production of high quality commercial polystyrene.

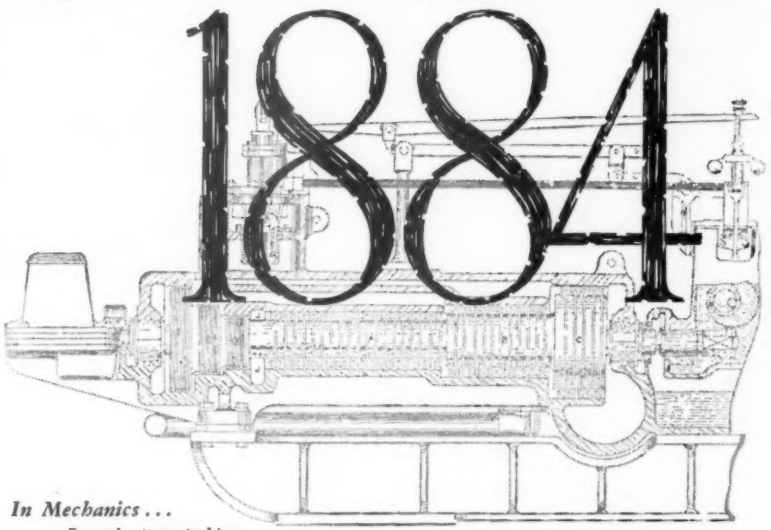
Of particular value in the three-page bulletin is the discussion of problems arising from high proportion of styrene monomer and other volatiles which can, in effect, depreciate an otherwise seemingly high-quality polystyrene. Bulletin is available from Koppers Company, Inc., Dept. PVP, 1450 Koppers Bldg., Pittsburgh 19, Pa.

CAN MARKING

The Data-line coding method for inscribing quality control information on metal cans is discussed in an eight-page bulletin published by the Triple-E-Engineering Co., Dept. PVP, Racine, Wisc. The new literature describes the Data-line process in detail and compares its advantages against longer-used can marking methods, such as embossing and printing.

Important dates in the History of Industrial Progress

1884



In Mechanics . . .

Parson's steam turbine, seen here in a longitudinal diagram, was the first step toward the huge turbines that supply motive power to generators in today's power plants.

In the history of fats and waxes

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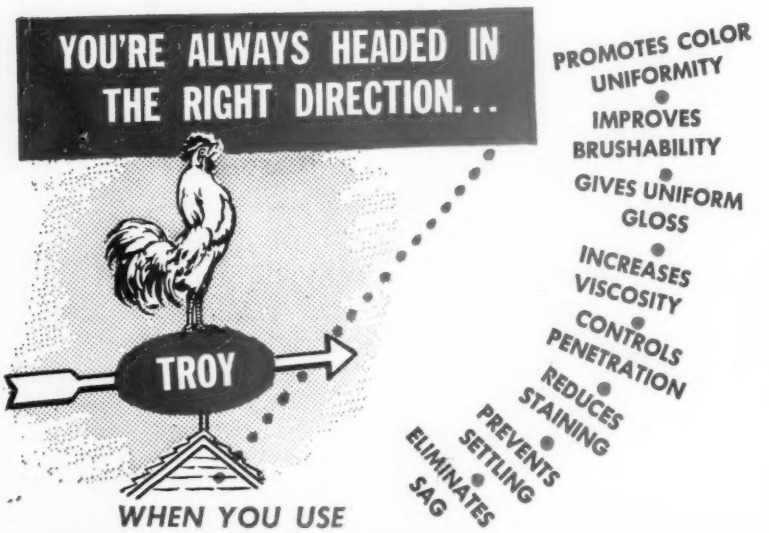
STEEL CONTAINERS

A 1956-1957 directory of steel shipping container manufacturers, covering by volume 95 per cent of total industry production, has just been published by the Steel Shipping Container Institute, Dept. PVP, 600 Fifth Ave., New York 20, N.Y.

In the new directory are tables providing quick product-manufacturer cross-reference and addresses for manufacturers' plants and offices. Also included are statistics on annual production of various container types and their uses by industries; historical material; general information on container specifications and recommended universal standards; and recent developments in container design and in coating research.

BATCH CONTROL SYSTEMS

Fischer & Porter Co., Dept. PVP, 812 Jacksonville Rd., Hatboro, Pa., has published a new four-page catalog, No. 91-109, which .escribes the company's batch control systems. These systems offer simple, dependable means for automatically adding a predetermined volume of fluid to a batch process.



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WOOD PRESERVATIVES

Protection Products Manufacturing Co. announces the release of "Recommendations for Preservation of Wood in Building Construction." These are detailed specifications covering the types of preservatives, methods of treatment, and degree of treatment required for the various items of lumber and millwork, commonly used in residential construction.

In developing the specifications, the company has considered geographical regions and adjusted its methods for such problems as termite infestation and severity of exposure. Recommendations are also provided in detail for the three basic types of residential construction, namely, slab-on-ground type, basement type, and crawl space type.

Copies of recommendations may be obtained from Protection Products Manufacturing Co., Dept. PVP, Box 747, Kalamazoo, Mich.

FLUID AGITATION HANDBOOK

A new handbook covers in detail theoretical and practical approaches to fluid mixing problems in the process industries. It outlines step-by-step procedures for determining optimum mixing characteristics of fluids in relation to their physical properties.

The "Fluid Agitation Handbook," as the literature is called, was originally a part of an experimental mixing kit. However, it has now been made available as an independent 46-page book, at cost.

Included in the book are numercus charts, diagrams, and photographs, some of which have not appeared in print before. Book is available for $1.50 postpaid, from Chemineer, Inc., Dept. PVP, 1044 East First St., Dayton 2, Ohio.

VINYL CHLORIDE RESINS

Six bulletins of the Firestone Plastics Co. have been bound together, each concerning one of a number of Exon vinyl chloride resins for solution coatings.

In the new binder, a brief statement identifying the outstanding characteristics of each resin is noted for easy reference. Also, for quick comparison, there is a graph

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showing the solubilities of these resins in methyl ethyl ketone.

Complete information concerning each individual resin can be found in its specific bulletin, as prepared at the original publication date. Charts and graphs are prevalent throughout.

Available from Firestone Plastics Co., Division of Firestone Tire & Rubber Co., Dept. PVP, Pottstown, Pa.

STATIC CONTROL

A new eight-page bulletin defines static control, lists its advantages, and describes components of General Electric's general-purpose static control system. The two-color publication explaining how static control operates, covers the logic function concept, logic functions and conventional control, circuit characteristics, monitor lights and amplifiers.

Bulletin is titled "Fundamentals and Features of General-Purpose Static Control Elements" and numbered as Bulletin GEA-6578. It may be obtained by addressing General Electric Co., Dept. PVP, Schenectady 5, N. Y.

ANTIFOAM AGENTS

A new, illustrated four-page folder describing different methods of feeding antifoam agents to batch and continuous process operations is available from Hodag Chemical Corp., Dept. PVP, 7247 No. Central Park, Chicago 45, Ill.

Application methods described in the Hodag folder range from simple manual feeders to complex automatic feeding systems. These antifoam application methods are generally adaptable to operations where foaming problems occur.

LATEX FINISH FOR METAL

Properties and applications of an experimental latex coating for industrial finishes on metal have been published in a 28-page bulletin from the Coatings Technical Service, Dow Chemical Co., Dept. PVP, Midland, Mich.

With the aid of numerous tables and formulations, the new coating, Latex X-2566, is thoroughly evaluated and discussed. Material for the bulletin is based on laboratory testings.

LABORATORY INSTRUMENTS

A new eight-page catalog, describing the complete line of Servall specialized laboratory instruments, has been issued by Ivan Sorvall, Inc., Dept. PVP, Norwalk, Conn.

Instruments discussed include angle centrifuges, ultra-microtomes, high-speed homogenizers, automatic pipettes, electrophoresis and chromatography equipment, gas and moisture testers, and a high-precision conductivity bridge.

EVAPORATION OF SOLVENTS

Evaporation data for many of the commercially available solvents, alcohols and hydrocarbon diluents are presented in Technical Bulletin No. SC:56-69 of the Shell Chemical Corp., Dept. PVP, 380 Madison Ave., New York 17, N.Y.

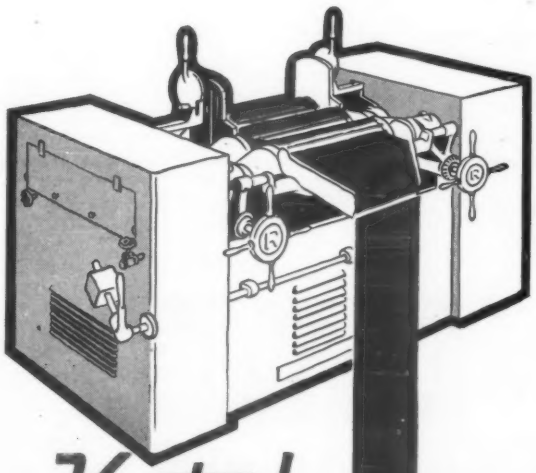
For convenient reference, data on material presented are divided into three groups—fast, medium, and slow—according to their evaporation rate. Statistical tables appear in each group, accompanied by graphic illustrations.

GRINDING MILLS

Jar mills and jar rolling mills are the subject of a 24-page catalog newly issued by Paul O. Abbe Inc., Dept. PVP, Little Falls, N.J.

The catalog explains mill selection and operation and includes sections on grinding media, jars, and accessories.

Detailed statistical tables accompany illustrations of the mills in the catalog.



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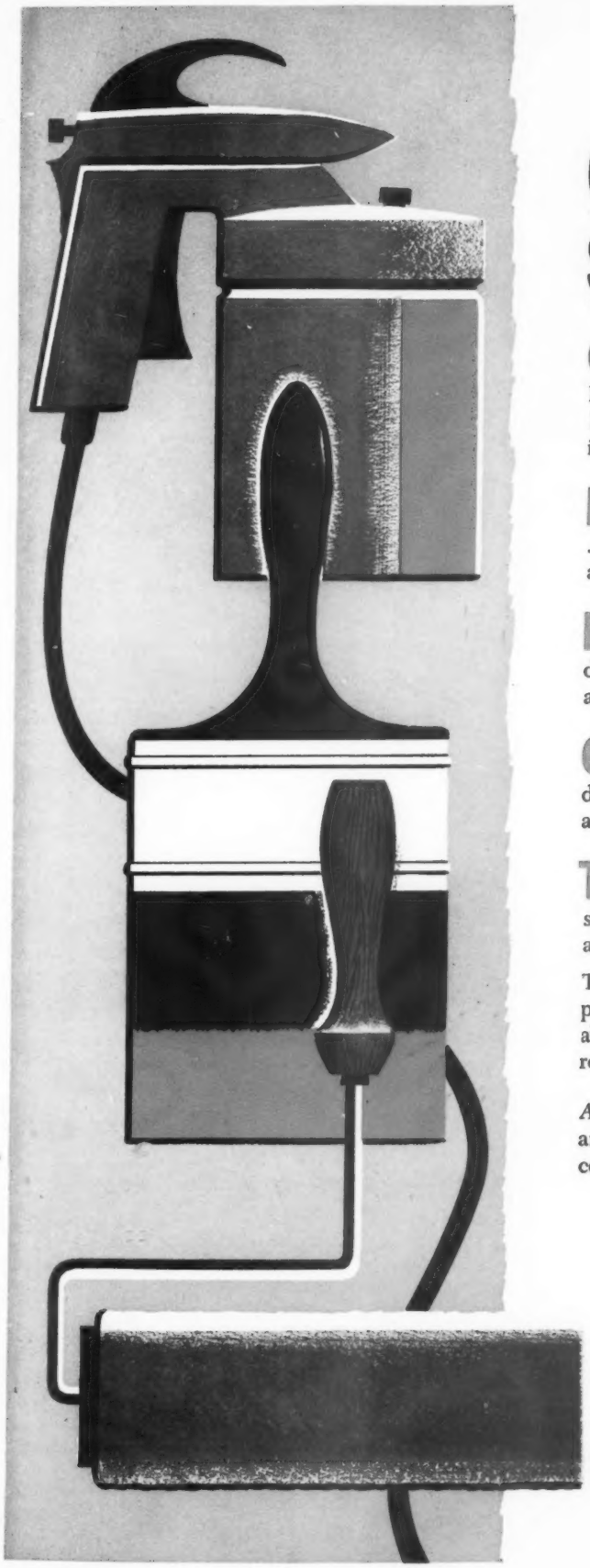

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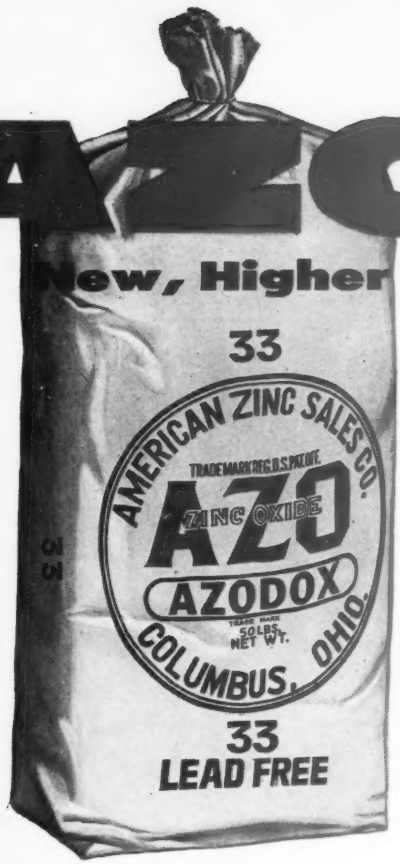

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